# ES-3124

*Intelligent Layer 3 Switch*
*24-port Fast Ethernet +*
*2 Gigabit Ethernet Ports*
*2 GbE Dual Personality Interfaces (Copper/SFP)*

# *User's Guide*

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ZyXEL

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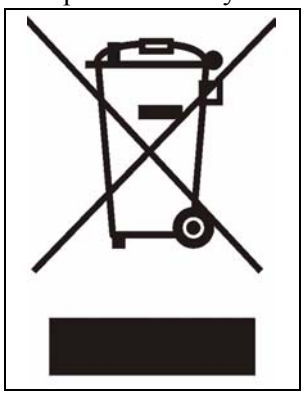

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# Preface

Congratulations on your purchase of the ES-3124 Intelligent Layer 3 Switch.

This preface introduces you to the ES-3124 and discusses the conventions of this User's Guide. It also provides information on other related documentation.

## About This User's Guide

This manual is designed to guide you through the installation and configuration of your ES-3124 for its various applications.

## Related Documentation

- Web Configurator Online Help

  Embedded web help for descriptions of individual screens and supplementary information.

- ZyXEL Web Site

  Please go to http://www.zyxel.com for product news, firmware, updated documents, and other support materials.

## Syntax Conventions

- "Enter" means for you to type one or more characters. "Select" or "Choose" means for you to use one of the predefined choices.
- Command and arrow keys are enclosed in square brackets. [ENTER] means the Enter, or carriage return key; [ESC] means the Escape key and [SPACE BAR] means the Space Bar.
- Mouse action sequences are denoted using a comma. For example, "In Windows, click **Start**, **Settings** and then **Control Panel**" means first click the **Start** button, then point your mouse pointer to **Settings** and then click **Control Panel**.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".
- The ES-3124 Intelligent Layer 3 Switch may be referred to as "the ES-3124" or "the switch" in this User's Guide.

## Graphics Icons Key

| | | |
|---|---|---|
| ES-3124 | Computer | Server |
| Computer | DSLAM | Gateway |
| Central Office/ ISP | Internet | Hub/Switch |

## User Guide Feedback

Help us help you. E-mail all User Guide-related comments, questions or suggestions for improvement to techwriters@zyxel.com.tw or send regular mail to The Technical Writing Team, ZyXEL Communications Corp., 6 Innovation Road II, Science-Based Industrial Park, Hsinchu, 300, Taiwan. Thank you.

# CHAPTER 1
# Getting to Know Your Switch

This chapter introduces the main features and applications of the switch.

## 1.1 Introduction

The ES-3124 is a stand-alone layer 3 Ethernet switch with 24 10/100Mbps ports, two RJ-45 Gigabit ports for stacking and 2 dual personality interfaces for uplink as well as a console port and a management port for local management. A dual personality interface includes one Gigabit port and one slot for mini-GBIC transceiver (SFP module) with one port active at a time.

With its built-in web configurator, managing and configuring the switch is easy. In addition, the switch can also be managed via Telnet, any terminal emulator program on the console port, or third-party SNMP management.

## 1.2 Software Features

This section describes the general software features of the switch.

### DHCP Client

DHCP (Dynamic Host Configuration Protocol RFC 2131 and RFC 2132) allows individual computers to obtain TCP/IP configuration at start-up from a server. You can configure the switch as a DHCP client to obtain TCP/IP information (such as the IP address and subnet mask) from a DHCP server. If you disable the DHCP service, you must manually enter the TCP/IP information.

### VLAN

A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same group(s); the traffic must first go through a router.

### Queuing

Queuing is used to help solve performance degradation when there is network congestion. Three scheduling services are supported: Strict Priority Queuing (SPQ), Weighted Round Robin (WRR) and Weighted Fair Schedule (WFS). This allows the switch to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.

### Port Mirroring

Port mirroring allows you to copy traffic going from one or all ports to another or all ports in order that you can examine the traffic from the mirror port (the port you copy the traffic to) without interference.

### Static Route

Static routes tell the switch how to forward IP traffic when you configure the TCP/IP parameters manually.

### IGMP Snooping

The switch supports IGMP snooping enabling group multicast traffic to be only forwarded to ports that are members of that group; thus allowing you to significantly reduce multicast traffic passing through your switch.

### Multicast VLAN Registration (MVR)

Multicast VLAN Registration (MVR) is designed for applications (such as Media-on-Demand (MoD)) using multicast traffic across a network. MVR allows one single multicast VLAN to be shared among different subscriber VLANs on the network.

This improves bandwidth utilization by reducing multicast traffic in the subscriber VLANs and simplifies multicast group management.

### STP (Spanning Tree Protocol) / RSTP (Rapid STP)

(R)STP detects and breaks network loops and provides backup links between switches, bridges or routers. It allows a switch to interact with other (R)STP -compliant switches in your network to ensure that only one path exists between any two stations on the network.

The switch allows you to create multiple STP configurations and assign ports to a specific tree.

### Link Aggregation

Link aggregation (trunking) is the grouping of physical ports into one logical higher-capacity link. You may want to trunk ports if for example, it is cheaper to use multiple lower-speed links than to under-utilize a high-speed, but more costly, single-port link.

### Port Authentication and Security

For security, the switch allows authentication using IEEE 802.1x with an external RADIUS server and port security that allows only packets with dynamically learned MAC addresses and/or configured static MAC addresses to pass through a port on the switch.

### VLAN Stacking

Use VLAN stacking to add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. By tagging the tagged frames ("double-tagged" frames), the service provider can manage up to 4,094 VLAN groups with each group containing up to 4,094 customer VLANs. This allows a service provider to provide different service, based on specific VLANs, for many different customers.

### Differentiated Services (DiffServ)

With DiffServ, the switch marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow.

### Classifier and Policy

You can create a policy to define actions to be performed on a traffic flow grouped by a classifier according to specific criteria such as the IP address, port number or protocol type, etc.

### Cluster Management

Cluster Management allows you to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another using same cluster management implementation.

### Maintenance and Management Features

- Access Control

  You can specify the service(s) and computer IP address(es) to control access to the switch for management.

- Cluster Management

  Cluster management (also known as iStacking) allows you to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another.

- Configuration and Firmware Maintenance

  You can backup or restore the switch configuration or upgrade the firmware on the switch.

### IP Protocols

- IP Host (No routing)
- Telnet for configuration and monitoring
- SNMP for management
    - SNMP MIB II (RFC 1213)
    - SNMP v1 RFC 1157
    - SNMPv2, SNMPv2c or later version, compliant with RFC 2011 SNMPv2 MIB for IP, RFC 2012 SNMPv2 MIB for TCP, RFC 2013 SNMPv2 MIB for UDP
    - Ethernet MIBs RFC 1643
    - Bridge MIBs RFC 1493
    - SMI RFC 1155
    - RMON RFC 1757
    - SNMPv2, SNMPv2c RFC 2674

### System Monitoring

- System status (link status, rates, statistics counters)
- SNMP
- Temperatures, voltage, fan speed reports and alarms
- Port Mirroring allows you to analyze one port's traffic from another.

### Security

- System management password protection
- Port-based VLAN
- IEEE 802.1Q VLAN
- 802.1x Authentication
- Limit dynamic port MAC address learning
- Static MAC address filtering

### Bandwidth Control

- The ES-3124 supports rate limiting in 64 Kbps increments allowing you to create different service plans.
- The ES-3124 supports IGMP snooping enabling group multicast traffic to be only forwarded to ports that are members of that group; thus allowing you to significantly reduce multicast traffic passing through your switch.
- Broadcast storm control

### Quality of Service

- Eight queues so you can ensure mission-critical data gets delivered on time.
- Follows the IEEE 802.1p priority setting standard based on source/destination MAC addresses.

# 1.3 Hardware Features

This section describes the hardware features of the ES-3124.

### 24 10/100 Mbps Fast Ethernet Ports

Connect up to 24 computers or switches to the 10/100 Mbps auto-negotiating, automatic cable sensing (auto-MDIX) Ethernet RJ-45 ports.

### Mini-GBIC Slots

Install SPF transceivers in these slots to connect to other Ethernet switches at longer distances than the Ethernet port.

### Gigabit Ethernet Ports

These ports allow the switch to connect to another WAN switch or daisy-chain to other switches.

### Management Port

Connect a computer to this port for management purposes. You cannot access the network through this port.

### Console Port

Use the console port for local management of the switch.

### Backup Power Supply Port

Connect a backup power supply device to this port to ensure uninterrupted network connection in the event of a power failure.

### Fans

The fans cool the switch sufficiently to allow reliable operation of the switch in even poorly ventilated rooms or basements.

### Power

The ES-3124 requires 100~240VAC/1.5A power.

# 1.4 Applications

This section shows a few examples of using the switch in various network environments.

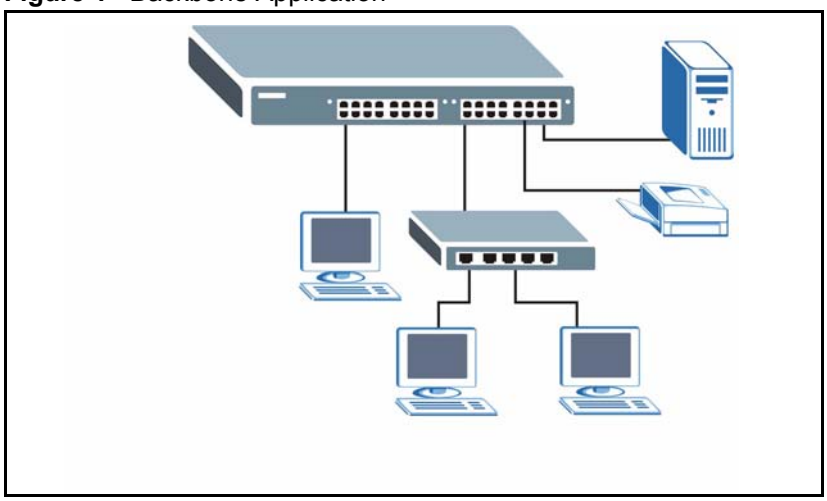
### 1.4.1 Backbone Application

In this application, the switch is an ideal solution for small networks where rapid growth can be expected in the near future.

The switch can be used standalone for a group of heavy traffic users. You can connect computers directly to the switch's port or connect other switches to the switch.

In this example, all computers can share high-speed applications on the server. To expand the network, simply add more networking devices such as switches, routers, computers, print servers etc.

**Figure 1** Backbone Application

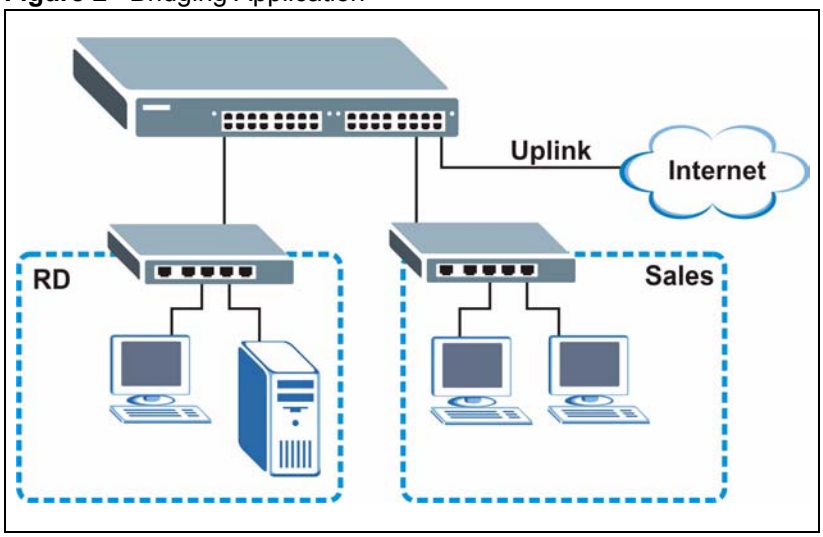


### 1.4.2 Bridging Example

In this example application the switch connects different company departments (**RD** and **Sales**) to the corporate backbone. It can alleviate bandwidth contention and eliminate server and network bottlenecks. All users that need high bandwidth can connect to high-speed department servers via the switch. You can provide a super-fast uplink connection by using a Gigabit Ethernet/mini-GBIC port on the switch.

Moreover, the switch eases supervision and maintenance by allowing network managers to centralize multiple servers at a single location.

**Figure 2** Bridging Application

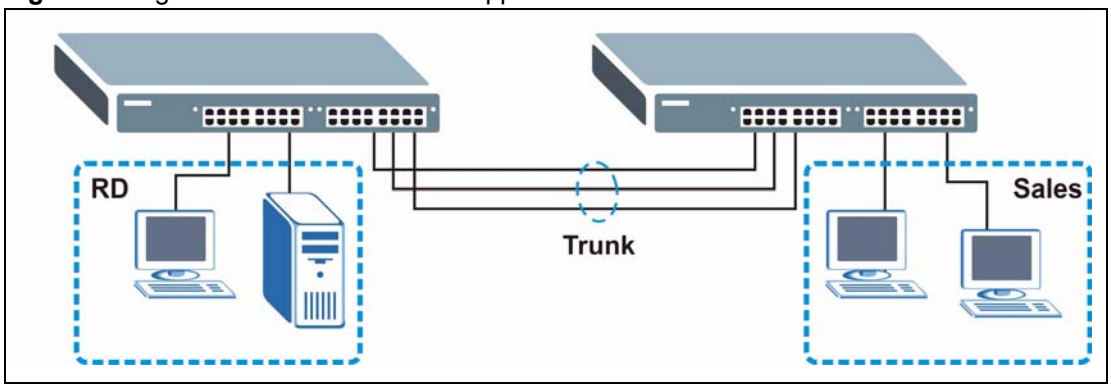



## 1.4.3 High Performance Switched Example

The switch is ideal for connecting two networks that need high bandwidth. In the following example, use trunking to connect these two networks.

Switching to higher-speed LANs such as ATM (Asynchronous Transmission Mode) is not feasible for most people due to the expense of replacing all existing Ethernet cables and adapter cards, restructuring your network and complex maintenance. The switch can provide the same bandwidth as ATM at much lower cost while still being able to use existing adapters and switches. Moreover, the current LAN structure can be retained as all ports can freely communicate with each other.

**Figure 3** High Performance Switched Application




## 1.4.4 IEEE 802.1Q VLAN Application Examples

This section shows a workgroup and a shared server example using 802.1Q tagged VLANs.

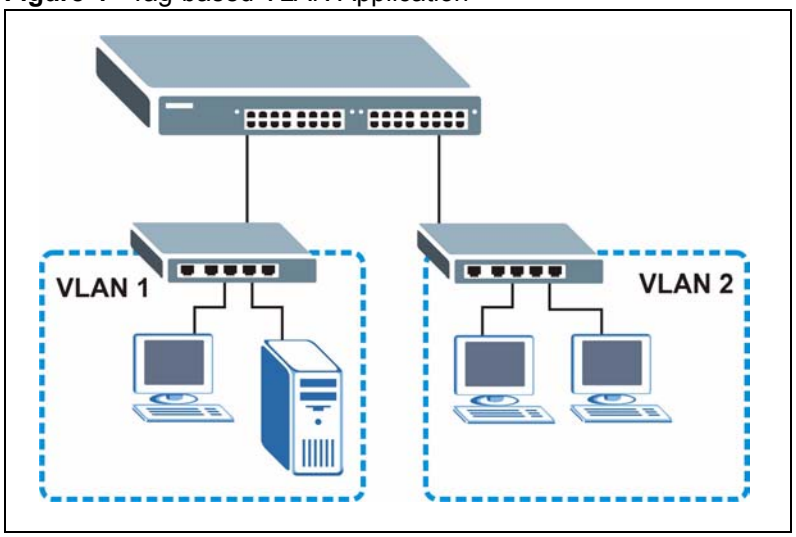
A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Stations on a logical network belong to one group. A station can belong to more than one group. With VLAN, a station cannot directly talk to or hear from stations that are not in the same group(s) unless such traffic first goes through a router.

For more information on VLANs, refer to Chapter 8 on page 85.

### 1.4.4.1 Tag-based VLAN Example

Ports in the same VLAN group share the same frame broadcast domain thus increase network performance through reduced broadcast traffic. VLAN groups can be modified at any time by adding, moving or changing ports without any re-cabling.

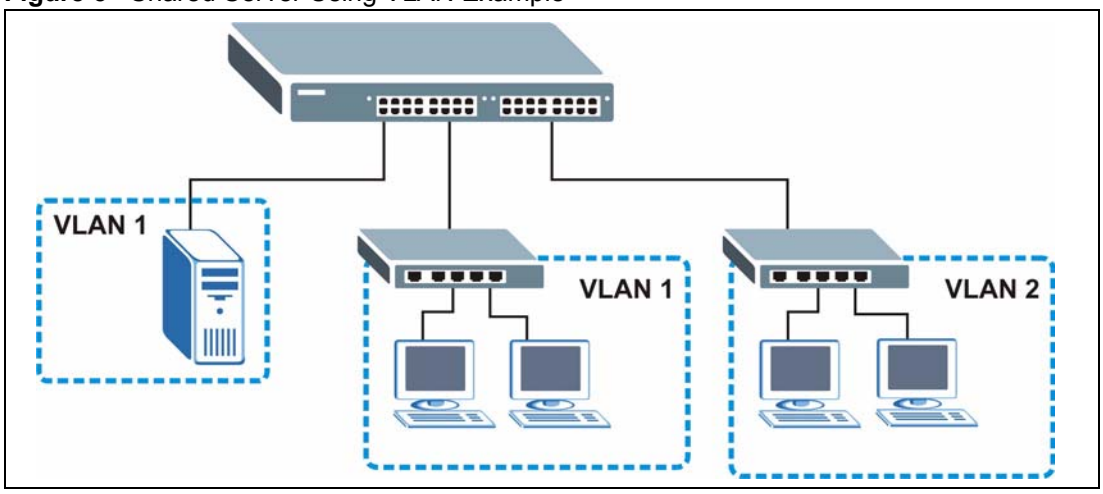
**Figure 4** Tag-based VLAN Application




### 1.4.4.2 VLAN Shared Server Example

Shared resources such as a server can be used by all ports in the same VLAN as the server, as shown in the following example. In this example, only ports that need access to the server need belong to VLAN 1. Ports can belong to other VLAN groups too.

**Figure 5** Shared Server Using VLAN Example



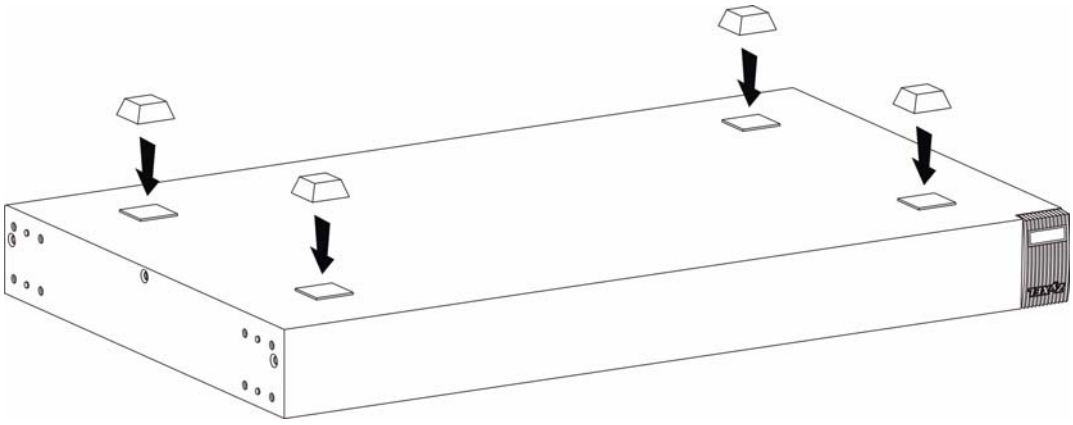
# CHAPTER 2
# Hardware Installation and Connection

This chapter shows you how to install and connect the switch.

## 2.1 Freestanding Installation

1. Make sure the switch is clean and dry.
2. Set the switch on a smooth, level surface strong enough to support the weight of the switch and the connected cables. Make sure there is a power outlet nearby.
3. Make sure there is enough clearance around the switch to allow air circulation and the attachment of cables and the power cord.
4. Remove the adhesive backing from the rubber feet.
5. Attach the rubber feet to each corner on the bottom of the switch. These rubber feet help protect the switch from shock or vibration and ensure space between devices when stacking.

**Figure 6** Attaching Rubber Feet



**Note:** Do NOT block the ventilation holes. Leave space between devices when stacking.

For proper ventilation, allow at least 4 inches (10 cm) of clearance at the front and 3.4 inches (8 cm) at the back of the switch. This is especially important for enclosed rack installations.

# 2.2 Mounting the Switch on a Rack

This section lists the rack mounting requirements and precautions and describes the installation steps.

## 2.2.1 Rack-mounted Installation Requirements

- Two mounting brackets.
- Eight M3 flat head screws and a #2 Philips screwdriver.
- Four M5 flat head screws and a #2 Philips screwdriver.

**Note:** Failure to use the proper screws may damage the unit.

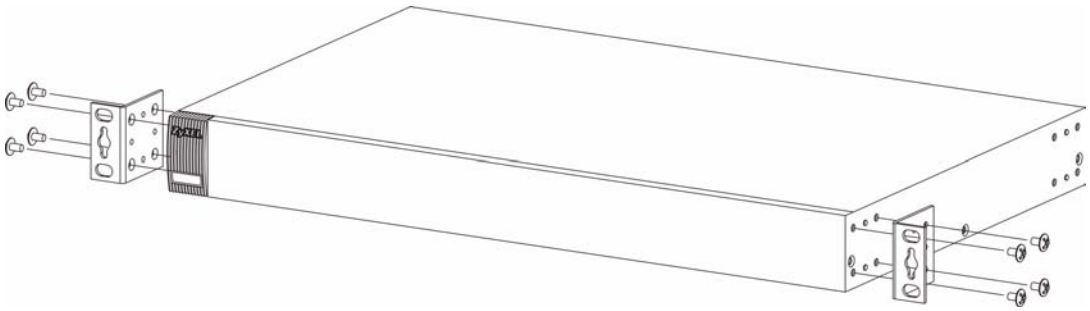
### 2.2.1.1 Precautions

- Make sure the rack will safely support the combined weight of all the equipment it contains.
- Make sure the position of the switch does not make the rack unstable or top-heavy. Take all necessary precautions to anchor the rack securely before installing the unit.

## 2.2.2 Attaching the Mounting Brackets to the Switch

**1** Position a mounting bracket on one side of the switch, lining up the four screw holes on the bracket with the screw holes on the side of the switch.

**Figure 7** Attaching the Mounting Brackets



**2** Using a #2 Philips screwdriver, install the M3 flat head screws through the mounting bracket holes into the switch.

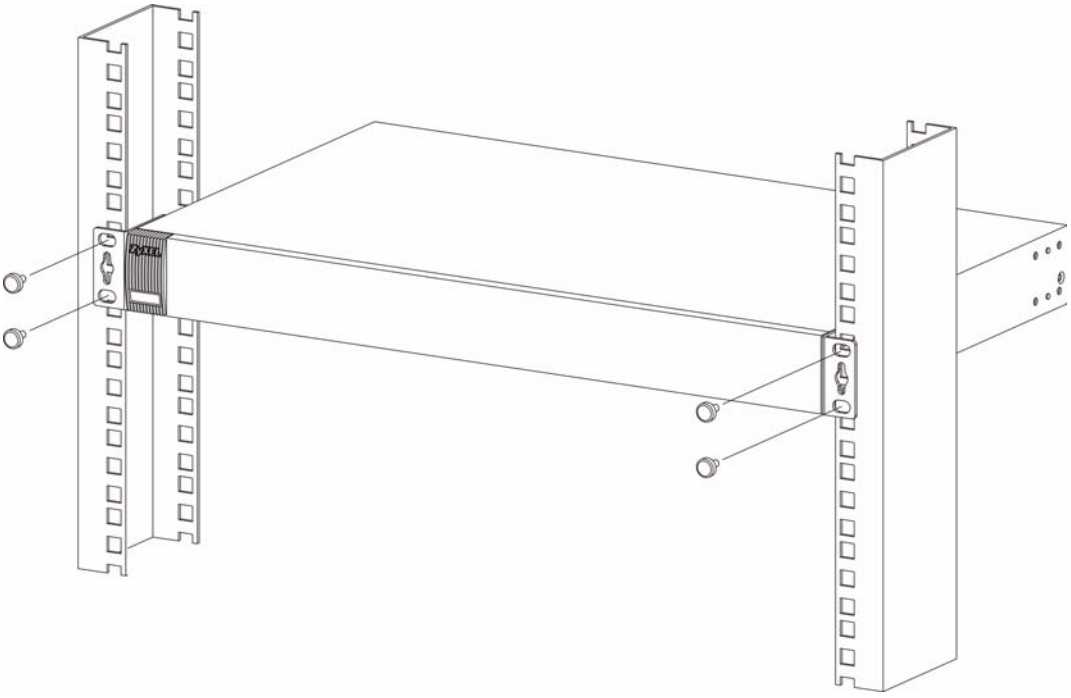
**3** Repeat steps 1 and 2 to install the second mounting bracket on the other side of the switch.

**4** You may now mount the switch on a rack. Proceed to the next section.

## 2.2.3 Mounting the Switch on a Rack

**1** Position a mounting bracket (that is already attached to the switch) on one side of the rack, lining up the two screw holes on the bracket with the screw holes on the side of the rack.

**Figure 8** Mounting the Switch on a Rack



**2** Using a #2 Philips screwdriver, install the M5 flat head screws through the mounting bracket holes into the rack.

**3** Repeat steps 1 and 2 to attach the second mounting bracket on the other side of the rack.

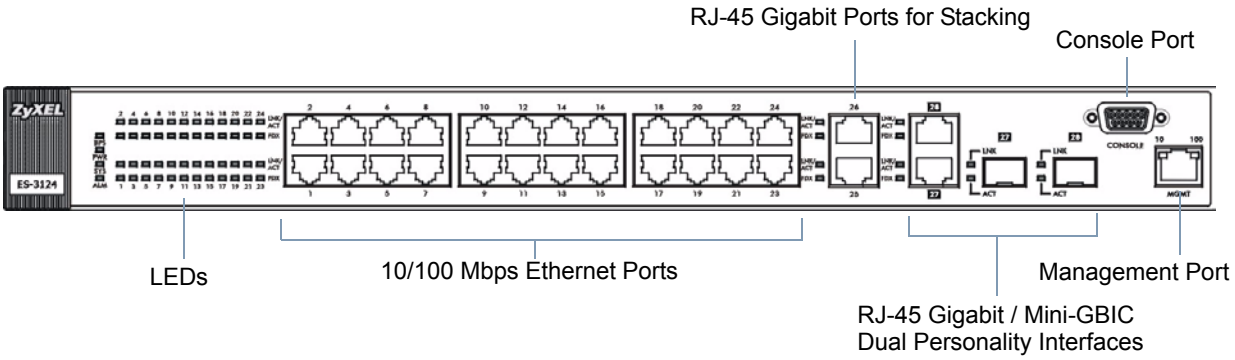
# CHAPTER 3
# Hardware Overview

This chapter describes the front panel and rear panel of the switch and shows you how to make the hardware connections.

## 3.1 Panel Connections

The figure below shows the front panel of the switch.

**Figure 9** Front Panel




The following table describes the ports on the panels.

**Table 1** Panel Connections

| CONNECTOR | DESCRIPTION |
|---|---|
| 24 10/100 Mbps RJ-45 Ethernet Ports | Connect these ports to a computer, a hub, an Ethernet switch or router. |
| 2 100/1000 Mbps RJ-45 Gigabit Ports | Connect these Gigabit Ethernet ports to high-bandwidth backbone network Ethernet switches or use them to daisy-chain other switches. |
| Two Dual Personality Interfaces | Each interface has one 1000 Base-T copper RJ-45 port and one Small Form-Factor Pluggable (SFP) fiber port, with one port active at a time. |
| 2 100/1000 Mbps RJ-45 Gigabit Ports | Connect these Gigabit Ethernet ports to high-bandwidth backbone network Ethernet switches. |
| Mini-GBIC Ports | Use mini-GBIC transceivers in these slots for fiber-optic connections to backbone Ethernet switches. |

**Table 1** Panel Connections (continued)

| CONNECTOR | DESCRIPTION |
|---|---|
| Console Port | Only connect this port if you want to configure the switch using the command line interface (CLI) via the console port. |
| Management Port | Connect to a computer using an RJ-45 Ethernet cable for local configuration of the switch. |

## 3.1.1 Console Port

For local management, you can use a computer with terminal emulation software configured to the following parameters:

- VT100 terminal emulation
- 9600 bps
- No parity, 8 data bits, 1 stop bit
- No flow control

Connect the male 9-pin end of the console cable to the console port of the switch. Connect the female end to a serial port (COM1, COM2 or other COM port) of your computer.

## 3.1.2 Ethernet Ports

The switch has 24 100/1000Mbps auto-negotiating, auto-crossover Ethernet ports. In 100/1000Mbps Fast Ethernet, the speed can be 100Mbps or 1000Mbps and the duplex mode can be half duplex or full duplex.

There are two pairs of Gigabit Ethernet/mini-GBIC ports. The mini-GBIC ports have priority over the Gigabit ports. This means that if a mini-GBIC port and the corresponding Gigabit port are connected at the same time, the Gigabit port will be disabled. The speed of the Gigabit Ethernet/mini-GBIC ports can be 100Mbps or 1000Mbps and the duplex mode can be half duplex (at 100 Mbps) or full duplex.

An auto-negotiating port can detect and adjust to the optimum Ethernet speed (100/1000Mpbs) and duplex mode (full duplex or half duplex) of the connected device.

An auto-crossover (auto-MDI/MDI-X) port automatically works with a straight-through or crossover Ethernet cable.

### 3.1.2.1 Default Ethernet Settings

The factory default negotiation settings for the Ethernet ports on the switch are:

- Speed: Auto
- Duplex: Auto
- Flow control: Off

## 3.1.3 Mini-GBIC Slots

These are slots for mini-GBIC (Gigabit Interface Converter) transceivers. A transceiver is a single unit that houses a transmitter and a receiver. The switch does not come with transceivers. You must use transceivers that comply with the SFP Transceiver MultiSource Agreement (MSA). See the SFF committee's INF-8074i specification Rev 1.0 for details.

There are two pairs of Gigabit Ethernet/mini-GBIC ports. The mini-GBIC ports have priority over the Gigabit ports. This means that if a mini-GBIC port and the corresponding Gigabit port are connected at the same time, the Gigabit port will be disabled.

You can change transceivers while the switch is operating. You can use different transceivers to connect to Ethernet switches with different types of fiber-optic connectors.

- Type: SFP connection interface
- Connection speed: 1 Gigabit per second (Gbps)

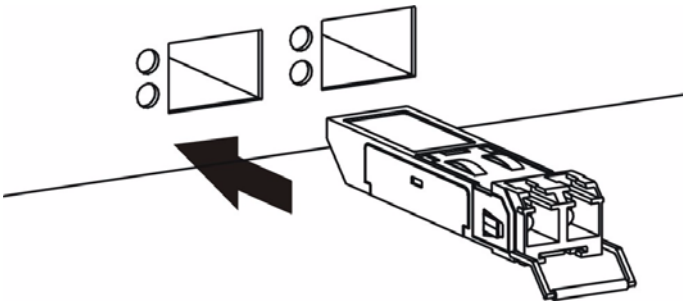
**Note:** To avoid possible eye injury, do not look into an operating fiber-optic module's connectors.

### 3.1.3.1 Transceiver Installation

Use the following steps to install a mini GBIC transceiver (SFP module).

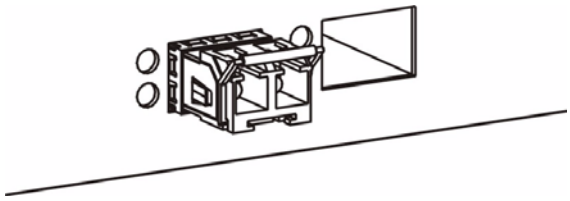
1. Insert the transceiver into the slot with the exposed section of PCB board facing down.

**Figure 10** Transceiver Installation Example



2. Press the transceiver firmly until it clicks into place.
3. The switch automatically detects the installed transceiver. Check the LEDs to verify that it is functioning properly.

**Figure 11** Installed Transceiver

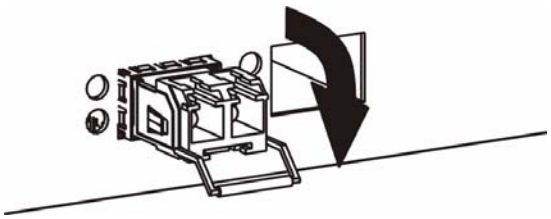


### 3.1.3.2 Transceiver Removal

Use the following steps to remove a mini GBIC transceiver (SFP module).

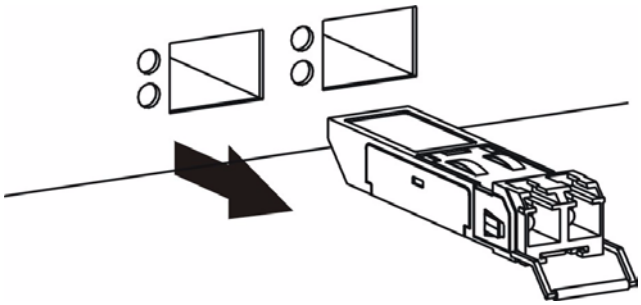
**1** Open the transceiver's latch (latch styles vary).

**Figure 12** Opening the Transceiver's Latch Example



**2** Pull the transceiver out of the slot.

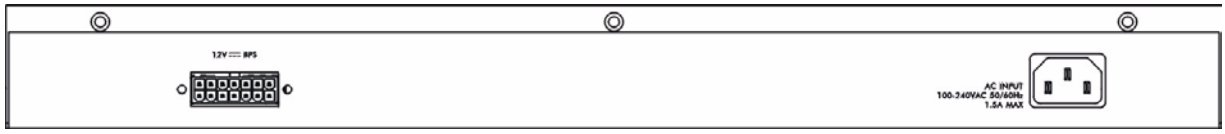
**Figure 13** Transceiver Removal Example



## 3.2 Rear Panel

The following figure shows the rear panel of the ES-3124. The rear panel contains the ventilation holes, a connector for external backup power supply (BPS) and the power receptacle.

**Figure 14** Rear Panel



## 3.2.1 Power Connector

Make sure you are using the correct power source as shown on the panel.

To connect the power to the switch, insert the female end of power cord to the power receptacle on the rear panel. Connect the other end of the supplied power cord to the power source. Make sure that no objects obstruct the airflow of the fans.

## 3.2.2 External Backup Power Supply Connector

The switch supports external backup power supply (BPS).

The backup power supply constantly monitors the status of the internal power supply. The backup power supply automatically provides power to the switch in the event of a power failure. Once the switch receives power from the backup power supply, it will not automatically switch back to using the internal power supply even when the power is resumed.

# 3.3 Front Panel LEDs

The following table describes the LEDs on the front panel.

**Table 2** Front Panel LEDs

| LED | COLOR | STATUS | DESCRIPTION |
|---|---|---|---|
| BPS | Green | Blinking | The system is receiving power from the backup power supply. |
| | | On | The backup power supply is connected and active. |
| | | Off | The backup power supply is not ready or not active. |
| | Amber | Blinking | The system cannot get power from the backup power supply. |
| PWR | Green | On | The system is turned on. |
| | | Off | The system is off. |
| SYS | Green | Blinking | The system is rebooting and performing self-diagnostic tests. |
| | | On | The system is on and functioning properly. |
| | | Off | The power is off or the system is not ready/malfunctioning. |
| ALM | Red | On | There is a hardware failure. |
| | | Off | The system is functioning normally. |

**Table 2** Front Panel LEDs (continued)

| LED | COLOR | STATUS | DESCRIPTION |
|---|---|---|---|
| LNK/ACT | Green | Blinking | The system is transmitting/receiving to/from a 1000 Mbps Ethernet network. |
| | | On | The link to a 1000 Mbps Ethernet network is up. |
| | Amber | Blinking | The system is transmitting/receiving to/from a 100 Mbps Ethernet network. |
| | | On | The link to a 100 Mbps Ethernet network is up. |
| | | Off | The link to an Ethernet network is down. |
| FDX | Amber | On | The Ethernet port is negotiating in full-duplex mode. |
| | | Off | The Ethernet port is negotiating in half-duplex mode and no collisions are occurring. |
| Gigabit Port | | | |
| LNK/ACT | Green | Blinking | The system is transmitting/receiving to/from a 1000 Mbps Ethernet network. |
| | | On | The link to a 1000 Mbps Ethernet network is up. |
| | Amber | Blinking | The system is transmitting/receiving to/from a 100 Mbps Ethernet network. |
| | | On | The link to a 100 Mbps Ethernet network is up. |
| | | Off | The link to an Ethernet network is down. |
| FDX | Amber | On | The Gigabit port is negotiating in full-duplex mode. |
| | | Off | The Gigabit port is negotiating in half-duplex mode and no collisions are occurring. |
| GBIC Slots | | | |
| LNK | Green | On | The port has a successful connection. |
| | | Off | No Ethernet device is connected to this port. |
| ACT | Green | Blinking | The port is receiving or transmitting data. |
| MGMT | | | |
| 10 | Green | Blinking | The system is transmitting/receiving to/from an Ethernet device. |
| | | On | The port is connected at 10 Mbps. |
| | | Off | The port is not connected at 10 Mbps or to an Ethernet device. |
| 100 | Amber | Blinking | The system is transmitting/receiving to/from an Ethernet device. |
| | | On | The port is connected at 100 Mbps. |
| | | Off | The port is not connected at 100 Mbps or to an Ethernet device. |

# CHAPTER 4
# The Web Configurator

This section introduces the configuration and functions of the web configurator.

## 4.1 Introduction

The web configurator is an HTML-based management interface that allows easy switch setup and management via Internet browser. Use Internet Explorer 6.0 and later or Netscape Navigator 7.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

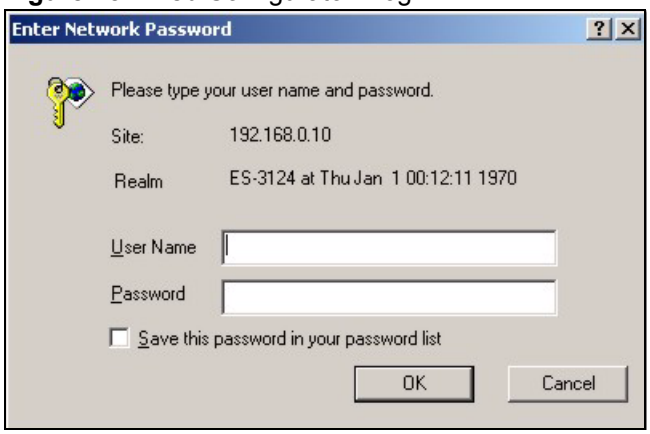
In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScript (enabled by default).
- Java permissions (enabled by default).

## 4.2 System Login

1. Start your web browser.
2. Type "http://" and the IP address of the switch (for example, the default for the management port is 192.168.0.1 and for the switch port is 192.168.1.1) in the **Location** or **Address** field. Press `[ENTER]`.
3. The login screen appears. The default username is **admin** and associated default password is **1234**. The date and time display as shown if you have not configured a time server nor manually entered a time and date in the **General Setup** screen.

**Figure 15** Web Configurator: Login



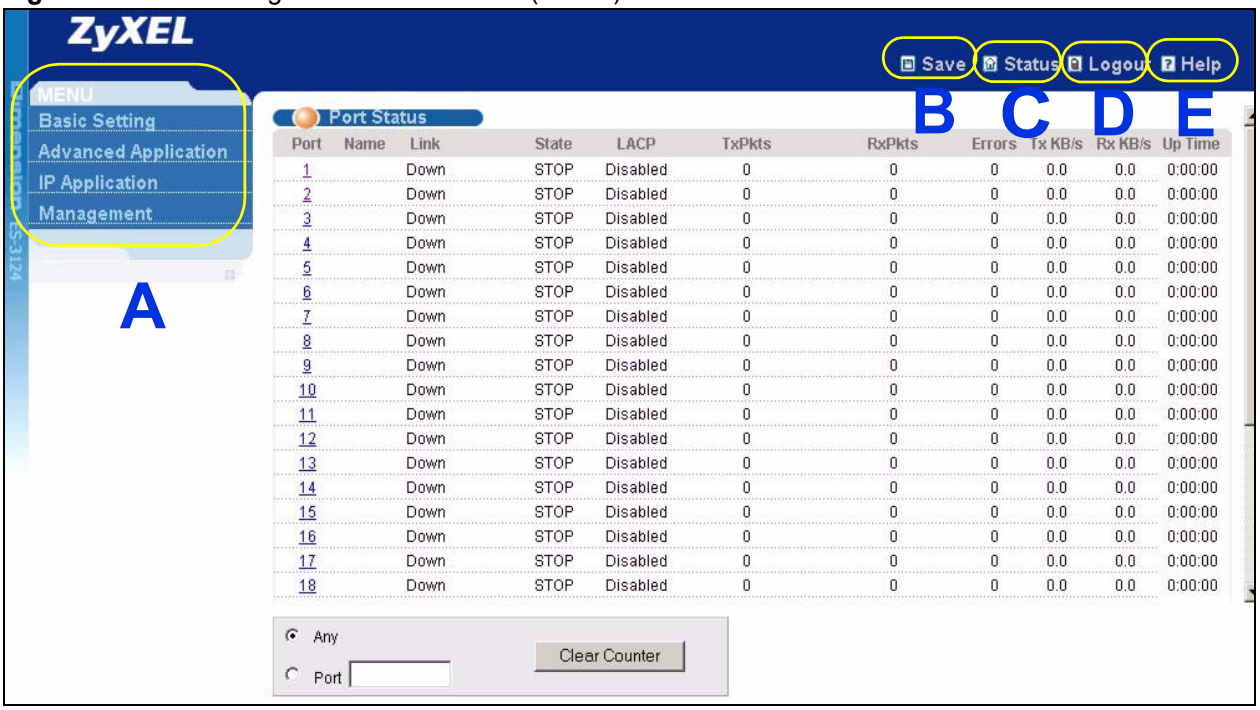
**4** Click **OK** to view the first web configurator screen.

## 4.3 The Status Screen

The **Status** screen is the first screen that displays when you access the web configurator.

The following figure shows the navigating components of a web configurator screen.

**Figure 16** Web Configurator Home Screen (Status)


ZyXEL
Save
Status
Logout
Help
MENU
Basic Setting
Advanced Application
IP Application
Management
A
B
C
D
E
Port Status
Port Name Link State LACP TxPkts RxPkts Errors Tx KB/s Rx KB/s Up Time
1 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
2 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
3 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
4 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
5 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
6 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
7 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
8 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
9 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
10 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
11 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
12 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
13 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
14 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
15 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
16 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
17 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
18 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
Any
Port
Clear Counter

**A** - Click the menu items to open submenu links, and then click on a submenu link to open the screen in the main window.

**B**, **C**, **D**, **E** - These are quick links which allow you to perform certain tasks no matter which screen you are currently working in.

**B** - Click this link to save your configuration into the switch's nonvolatile memory. Nonvolatile memory is the configuration of your switch that stays the same even if the switch's power is turned off.

**C** - Click this link to go to the status page of the switch.

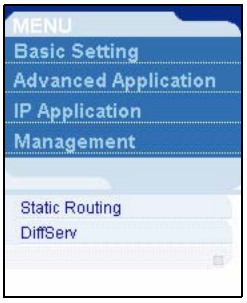
**D** - Click this link to logout of the web configurator.

**E** - Click this link to display web help pages. The help pages provide descriptions for all of the configuration screens.

# 4.4 Menu Overview

In the navigation panel, click a main link to reveal a list of submenu links.

**Table 3** Navigation Panel Sub-links Overview

| BASIC SETTING | ADVANCED APPLICATION | ROUTING PROTOCOL | MANAGEMENT |
|---|---|---|---|
| | |  | |

The following table lists the various web configurator screens within the sub-links.

**Table 4** Web Configurator Screen Sub-links Details

| BASIC SETTING | ADVANCED APPLICATION | ROUTING PROTOCOL | MANAGEMENT |
|---|---|---|---|
| System Info<br>General Setup<br>Switch Setup<br>IP Setup<br>Port Setup | VLAN<br>VLAN Status<br>VLAN Port Setting<br>Protocol Based VLAN<br>Static VLAN<br>Static MAC Forwarding<br>Filtering<br>Spanning Tree Protocol<br>Status<br>Configuration<br>Bandwidth Control<br>Broadcast Storm Control<br>Mirroring<br>Link Aggregation<br>Status<br>Configuration<br>Link Aggregation<br>Status<br>Configuration<br>Port Authentication<br>RADIUS<br>802.1x<br>Port Security<br>Classifier<br>Policy Rule<br>Queuing Method<br>VLAN Stacking<br>Multicast<br>Multicast Status<br>Multicast Setting<br>IGMP Filtering Profile<br>MVR<br>DHCP Relay | Static Routing<br>DiffServ<br>DiffServ Setting<br>DSCP Setting | Maintenance<br>Firmware Upgrade<br>Restore Configuration<br>Backup Configuration<br>Load Factory Default<br>Reboot System<br>Access Control<br>SNMP<br>Logins<br>Service Access Control<br>Remote Management<br>Diagnostic<br>Syslog<br>Setup<br>Server Setup<br>Cluster Management<br>Status<br>Configuration<br>MAC Table<br>ARP Table<br>Configure Clone |

The following table describes the links in the navigation panel.

**Table 5** Navigation Panel Links

| LINK | DESCRIPTION |
|---|---|
| Basic Settings | |
| System Info | This link takes you to a screen that displays general system and hardware monitoring information. |
| General Setup | This link takes you to a screen where you can configure general identification information about the switch. |
| Switch Setup | This link takes you to a screen where you can set up global switch parameters such as VLAN type, MAC address learning, GARP and priority queues. |
| IP Setup | This link takes you to a screen where you can configure the management IP address, subnet mask (necessary for switch management) and DNS (domain name server). |
| Port Setup | This link takes you to screens where you can configure settings for individual switch ports. |
| Advanced Application | |
| VLAN | This link takes you to screens where you can configure port-based or 802.1Q VLAN (depending on what you configured in the Switch Setup menu). |
| Static MAC Forwarding | This link takes you to screens where you can configure static MAC addresses for a port. These static MAC addresses do not age out. |
| Filtering | This link takes you to a screen to set up filtering rules. |
| Spanning Tree Protocol | This link takes you to screens where you can configure the STP/RSTP to prevent network loops. |
| Bandwidth Control | This link takes you to screens where you can cap the maximum incoming bandwidth allowed on specified port(s). |
| Broadcast Storm Control | This link takes you to a screen to set up broadcast filters. |
| Mirroring | This link takes you to screens where you can copy traffic from one port or ports to another port in order that you can examine the traffic from the first port without interference |
| Link Aggregation | This link takes you to a screen where you can logically aggregate physical links to form one logical, higher-bandwidth link. |
| Port Authentication | This link takes you to a screen where you can configure RADIUS (Remote Authentication Dial-In User Service), a protocol for user authentication that allows you to use an external server to validate an unlimited number of users. |
| Port Security | This link takes you to a screen where you can activate maximum port security through the use of configured static MAC addresses. |
| Classifier | This link takes you to a screen where you can configure classifiers. |
| Policy Rule | This link takes you to a screen where you can configure policy rules. |
| Queuing Method | This link takes you to a screen where you can configure strictly priority or weighted fair scheduling with associated queue weights for each port. |
| VLAN Stacking | This link takes you to a screen where you can configure VLAN stacking. |
| Multicast | This link takes you to a screen where you can configure various multicast features and create multicast VLANs. |
| DHCP Relay | This link takes you to a screen where you can configure DHCP relay information and specify the DHCP server(s). |

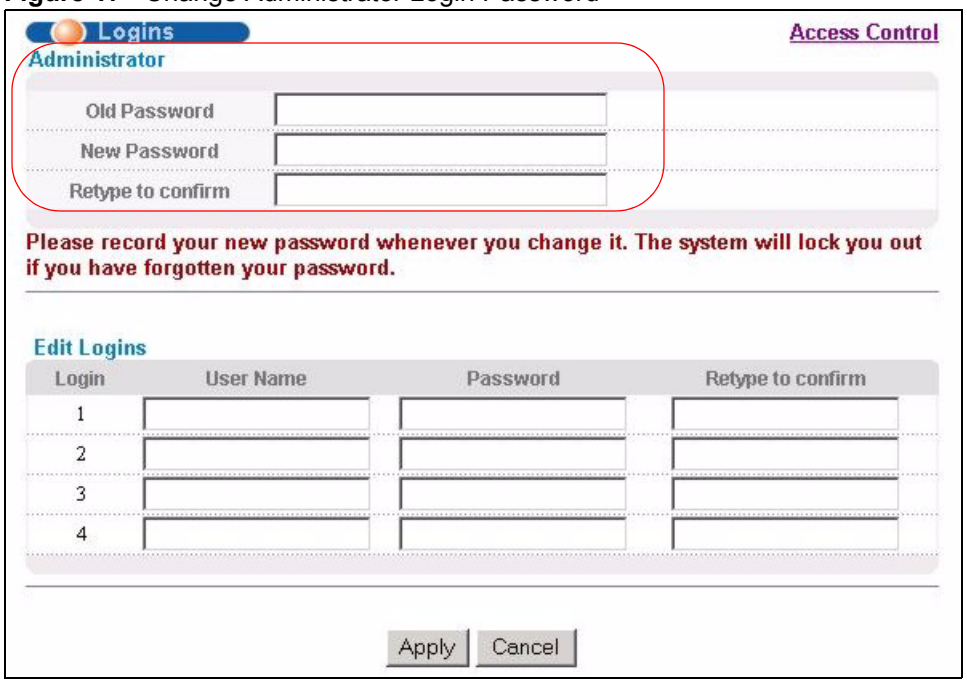
**Table 5** Navigation Panel Links (continued)

| LINK | DESCRIPTION |
|---|---|
| Routing Protocol | |
| Static Routing | This link takes you to screens where you can configure static routes. A static route defines how the switch should forward traffic by configuring the TCP/IP parameters manually. |
| DiffServ | This link takes you to screens where you can configure DiffServ and DSCP settings. |
| Management | |
| Maintenance | This link takes you to screens where you can perform firmware and configuration file maintenance as well as reboot the system. |
| Access Control | This link takes you to screens where you can change the system login password and configure SNMP and remote management. |
| Diagnostic | This link takes you to screens where you can view system logs and test port(s). |
| Syslog | This link takes you to screens where you can setup system logs and a system log server. |
| Cluster Management | This link takes you to a screen where you can configure clustering management and view its status. |
| MAC Table | This link takes you to a screen where you can view the MAC addresses (and types) of devices attached to what ports and VLAN IDs. |
| ARP Table | This link takes you to a screen where you can view the MAC addresses – IP address resolution table. |
| Configure Clone | This link takes you to a screen where you can clone port attributes of a port and transfer them to other port(s). |

### 4.4.1 Change Your Password

After you log in for the first time, it is recommended you change the default administrator password. Click **Management**, **Access Control** and then **Logins** to display the next screen.

**Figure 17** Change Administrator Login Password




## 4.5 Saving Your Configuration

When you are done modifying the settings in a screen, click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the ES-3124's power is turned off.

Click the **Save** link in the upper right hand corner of the web configurator to save your configuration to nonvolatile memory. Nonvolatile memory refers to the ES-3124's storage that remains even if the ES-3124's power is turned off.

**Note:** Use the **Save** link when you are done with a configuration session.

## 4.6 Switch Lockout

You could block yourself (and all others) from accessing the switch through the web configurator if you do one of the following:

1. Deleting the management VLAN (default is VLAN 1).
2. Deleting all port-based VLANs with the CPU port as a member. The "CPU port" is the management port of the switch.
3. Filtering all traffic to the CPU port.
4. Disabling all ports.
5. Misconfiguring the text configuration file.

6 Forgetting the password and/or IP address.

7 Preventing all services from accessing the switch.

8 Changing a service port number but forgetting it.

**Note:** Be careful not to lock yourself and others out of the switch.

Try using the out-of-band management port before resetting the switch. The default IP address is 192.168.0.1.

## 4.7 Resetting the Switch

If you lock yourself (and others) out of the switch, you can try using out-of-band management. If you still cannot correct the situation or forgot the password, you will need to reload the factory-default configuration file.

### 4.7.1 Reload the Configuration File

Uploading the factory-default configuration file replaces the current configuration file with the factory-default configuration file. This means that you will lose all previous configurations and the speed of the console port will be reset to the default of 9600bps with 8 data bit, no parity, one stop bit and flow control set to none. The password will also be reset to "1234" and the IP address to 192.168.1.1.

To upload the configuration file, do the following:

1 Connect to the console port using a computer with terminal emulation software. See Section 3.1.1 on page 46 for details.

2 Disconnect and reconnect the switch's power to begin a session. When you reconnect the switch's power, you will see the initial screen.

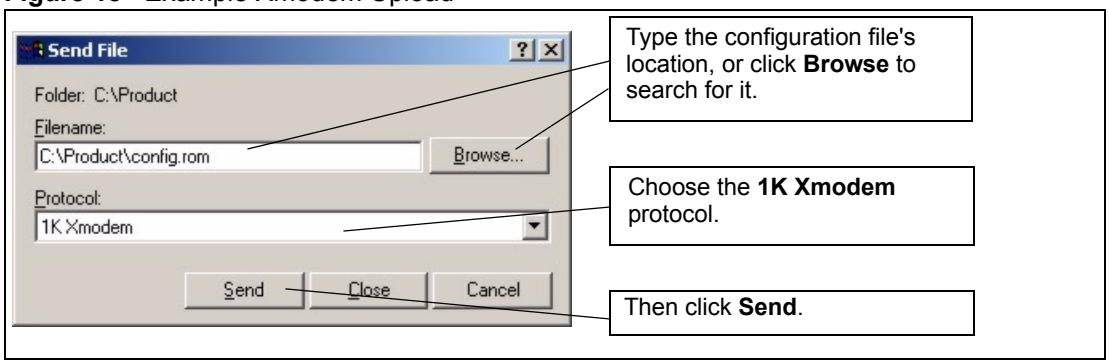
3 When you see the message "`Press any key to enter Debug Mode within 3 seconds ...`" press any key to enter debug mode.

4 Type `atlc` after the "`Enter Debug Mode`" message.

5 Wait for the "`Starting XMODEM upload`" message before activating XMODEM upload on your terminal.

6 This is an example Xmodem configuration upload using HyperTerminal. Click **Transfer**, then **Send File** to display the following screen.

**Figure 18** Example Xmodem Upload




**7** After a configuration file upload, type `atgo` to restart the switch.

**Figure 19** Reload the Configuration file: Via Console Port

```
Bootbase Version: V0.6 | 03/06/2006 09:21:13
RAM:Size = 32 Mbytes
DRAM POST: Testing: 32768K OK
DRAM Test SUCCESS !
FLASH: Intel 32M

ZyNOS Version: 3.70(AID.0)b0 | 4/28/2006 17:27:36

Press any key to enter debug mode within 3 seconds.
.................................
Enter Debug Mode

ES-3124> atlc
Starting XMODEM upload (CRC mode)....
CCCCCCCCCCCCCCC
Total  262144 bytes received.
Erasing..
.............................................................
OK
ES-3124> atgo
```

The switch is now reinitialized with a default configuration file including the default password of "1234".

## 4.7.2 Reset to the Factory Defaults

To reset the switch back to the factory defaults, do the following:

1. Connect to the console port using a computer with terminal emulation software. See the chapter on hardware connections for details.
2. Disconnect and reconnect the switch's power to begin a session. When you reconnect the switch's power, you will see the initial screen.
3. When you see the message "`Press any key to enter Debug Mode within 3 seconds`" press any key to enter debug mode.

4 Type `atbr` after the "`Enter Debug Mode`" message.

**Figure 20** Resetting the Switch: Via the Console Port

```
Bootbase Version: V0.6 | 03/06/2006 09:21:13
RAM:Size = 32 Mbytes
DRAM POST: Testing: 32768K OK
DRAM Test SUCCESS !
FLASH: Intel 32M

ZyNOS Version: 3.70(AID.0)b0 | 4/28/2006 17:27:36

Press any key to enter debug mode within 3 seconds.
.............................
Enter Debug Mode

ES-3124> atbr
Restore default
Romfile.....................................................
.........OK
ES-3124> atgo
```

5 After the resetting, type `atgo` to restart the switch.

## 4.8 Logging Out of the Web Configurator

Click **Logout** in a screen to exit the web configurator. You have to log in with your password again after you log out. This is recommended after you finish a management session both for security reasons and so as you don't lock out other switch administrators.

**Figure 21** Web Configurator: Logout Screen

## 4.9 Help

The web configurator's online help has descriptions of individual screens and some supplementary information.

Click the **Help** link from a web configurator screen to view an online help description of that screen.

# CHAPTER 5
# Initial Setup Example

This chapter shows how to set up the switch for an example network.

## 5.1 Overview

The following lists the configuration steps for the initial setup:

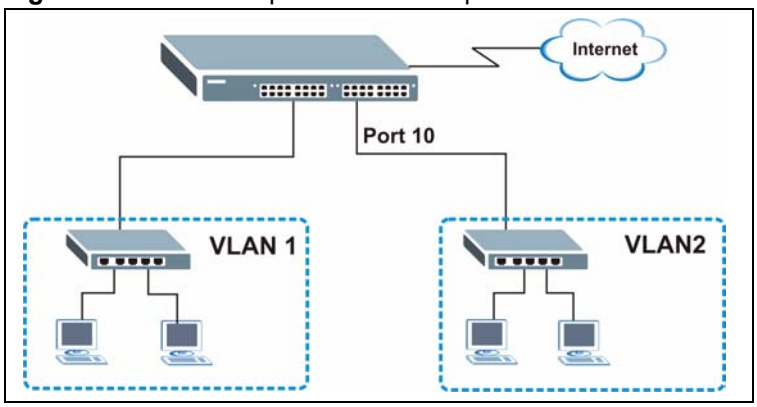
- Create a VLAN
- Set port VLAN ID
- Configure the switch IP management address

### 5.1.1 Creating a VLAN

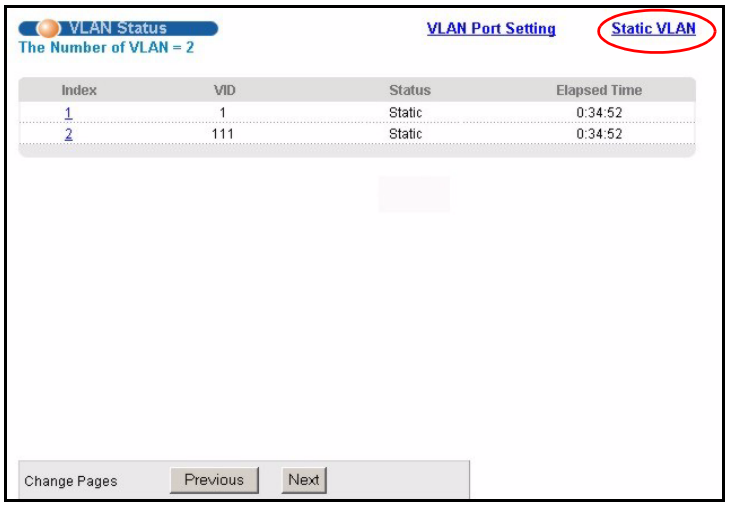
VLANs confine broadcast frames to the VLAN group in which the port(s) belongs. You can do this with port-based VLAN or tagged static VLAN with fixed port members.

In this example, you want to configure port 10 as a member of VLAN 2.

**Figure 22** Initial Setup Network Example: VLAN

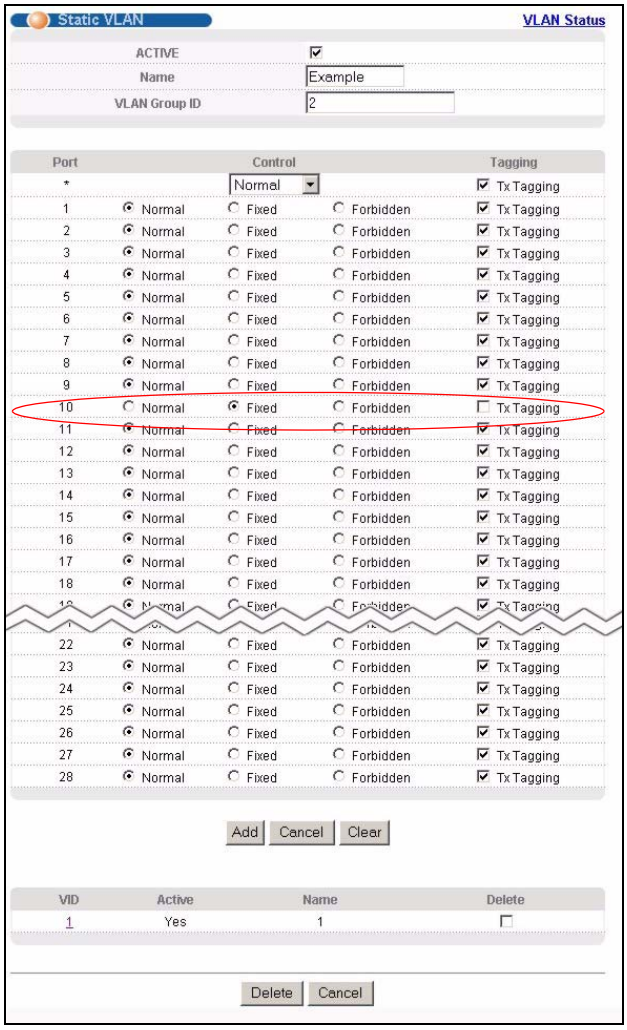


1 Click **Advanced Application** and **VLAN** in the navigation panel and click the **Static VLAN** link.




2 In the **Static VLAN** screen, select **ACTIVE**, enter a descriptive name in the **Name** field and enter 2 in the **VLAN Group ID** field for the **VLAN2** network.

**Note:** The **VLAN Group ID** field in this screen and the **VID** field in the **IP Setup** screen refer to the same VLAN ID.




3 Since the **VLAN2** network is connected to port 10 on the switch, select **Fixed** to configure port 10 to be a permanent member of the VLAN only.

4 To ensure that VLAN-unaware devices (such as computers and hubs) can receive frames properly, clear the **TX Tagging** check box to set the switch to remove VLAN tags before sending.

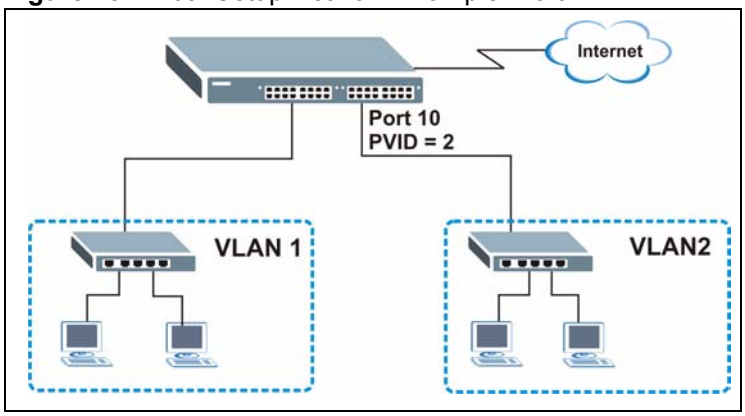
5 Click **Add** to save the settings to the run-time memory. Settings in the run-time memory are lost when the ES-3124's power is turned off.

## 5.1.2 Setting Port VID

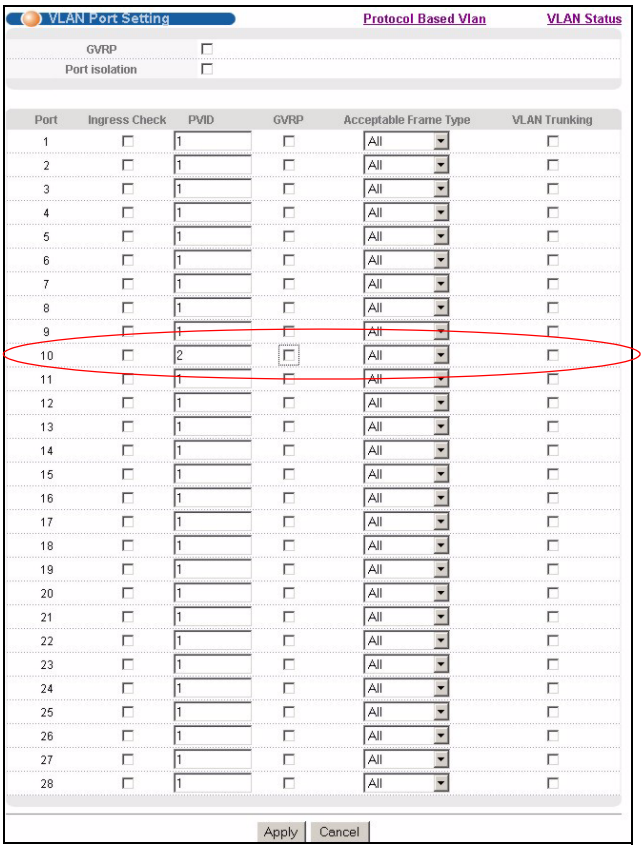
Use PVID to add a tag to incoming untagged frames received on that port so that the frames are forwarded to the VLAN group that the tag defines.

In the example network, configure 2 as the port VID on port 10 so that any untagged frames received on that port get sent to VLAN 2.

**Figure 23** Initial Setup Network Example: Port VID



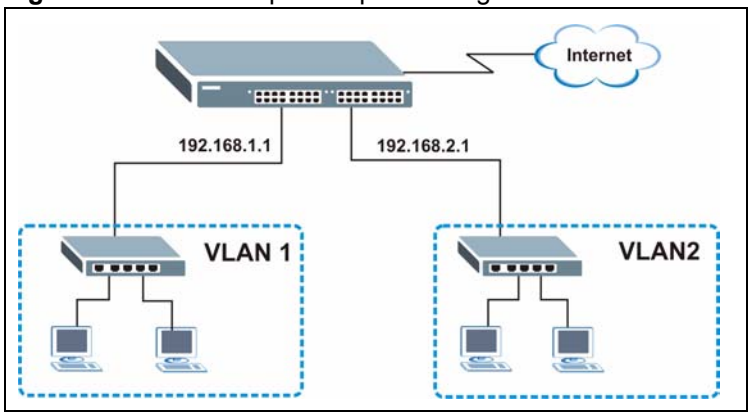

1. Click **Advanced Applications** and **VLAN** in the navigation panel. Then click the **VLAN Port Setting** link.
2. Enter 2 in the **PVID** field for port 10 and click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the ES-3124's power is turned off.



## 5.2 Configuring Switch Management IP Address

The default management IP address of the switch is 192.168.1.1. You can configure another IP address in a different subnet for management purposes. The following figure shows an example.

**Figure 24** Initial Setup Example: Management IP Address



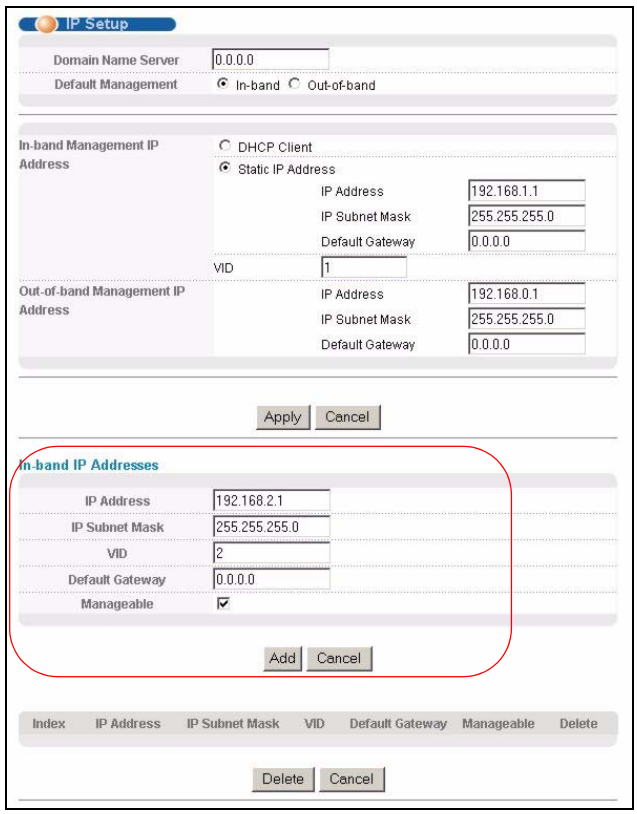

1 Connect your computer to any Ethernet port on the switch. Make sure your computer is in the same subnet as the switch.

2 Open your web browser and enter 192.168.1.1 (the default IP address) in the address bar to access the web configurator. See Section 4.2 on page 51 for more information.

3 Click **Basic Setting** and **IP Setup** in the navigation panel.

4 Configure the related fields in the **IP Setup** screen.

For the **VLAN2** network, enter 192.168.2.1 as the IP address and 255.255.255.0 as the subnet mask.




5 In the **VID** field, enter the ID of the VLAN group to which you want this management IP address to belong. This is the same as the VLAN ID you configure in the **Static VLAN** screen.

6 Select the **Manageable** check box to allow the switch to be managed from the ports belonging to **VLAN2** using this specified IP address.

Click **Add** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the ES-3124's power is turned off.

# CHAPTER 6
# System Status and Port Statistics

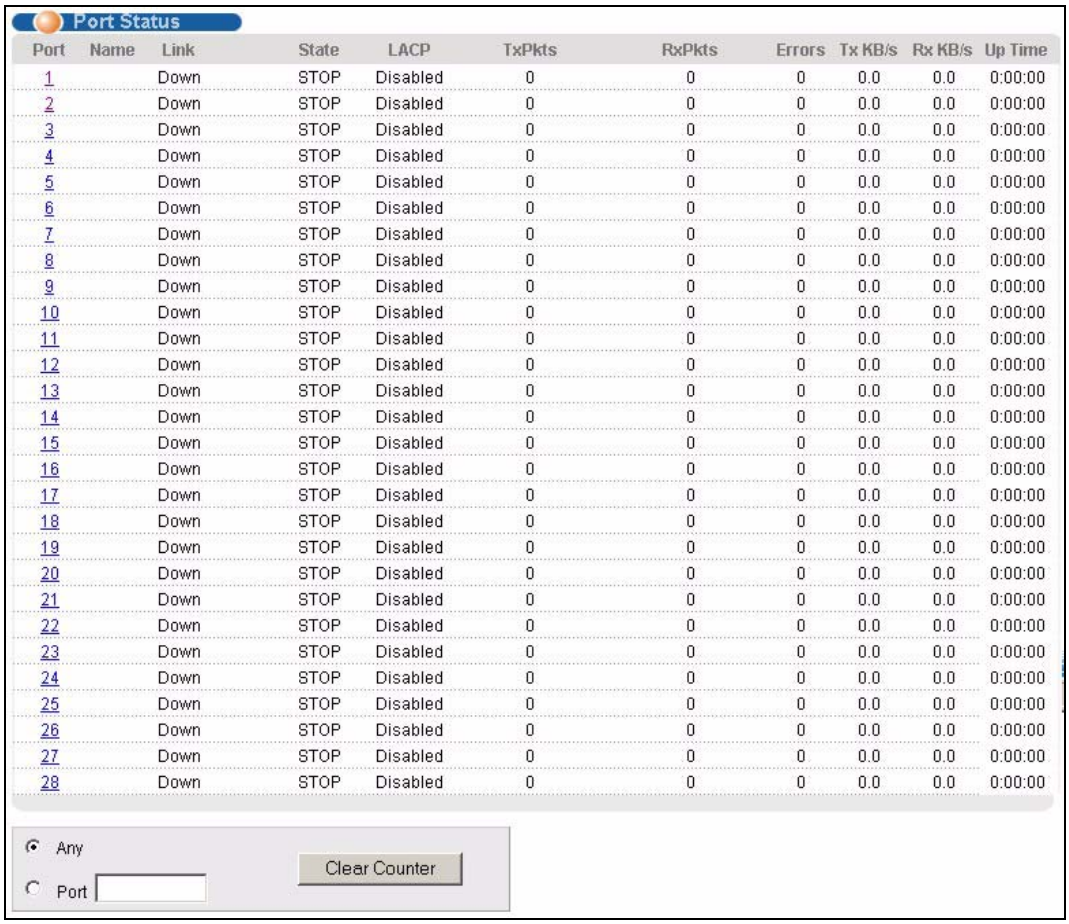
This chapter describes the system status (web configurator home page) and port details screens.

## 6.1 Port Status Summary

The home screen of the web configurator displays a port statistical summary table with links to each port showing statistical details.

To view the port statistics, click **Status** in all web configurator screens to display the **Status** screen as shown next.

**Figure 25** Status


Port Status
Port Name Link State LACP TxPkts RxPkts Errors Tx KB/s Rx KB/s Up Time
1 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
2 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
3 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
4 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
5 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
6 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
7 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
8 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
9 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
10 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
11 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
12 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
13 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
14 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
15 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
16 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
17 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
18 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
19 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
20 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
21 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
22 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
23 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
24 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
25 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
26 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
27 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
28 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
Any
Port
Clear Counter

The following table describes the labels in this screen.

**Table 6** Status

| LABEL | DESCRIPTION |
|---|---|
| Port | This identifies the Ethernet port. Click a port number to display the **Port Details** screen (refer to Figure 26 on page 68). |
| Name | This is the name you assigned to this port in the **Basic Setting**, **Port Setup** screen. |
| Link | This field displays the speed (either **10M** for 10Mbps, **100M** for 100Mbps or **1000M** for 1000Mbps) and the duplex (**F** for full duplex or **H** for half). It also shows the cable type (**Copper** or **Fiber**) for the combo ports. |
| State | If STP (Spanning Tree Protocol) is enabled, this field displays the STP state of the port (see Section 11.1.3 on page 108 for more information).<br>If STP is disabled, this field displays FORWARDING if the link is up, otherwise, it displays STOP. |
| LACP | This fields displays whether LACP (Link Aggregation Control Protocol) has been enabled on the port. |
| TxPkts | This field shows the number of transmitted frames on this port. |
| RxPkts | This field shows the number of received frames on this port. |
| Errors | This field shows the number of received errors on this port. |

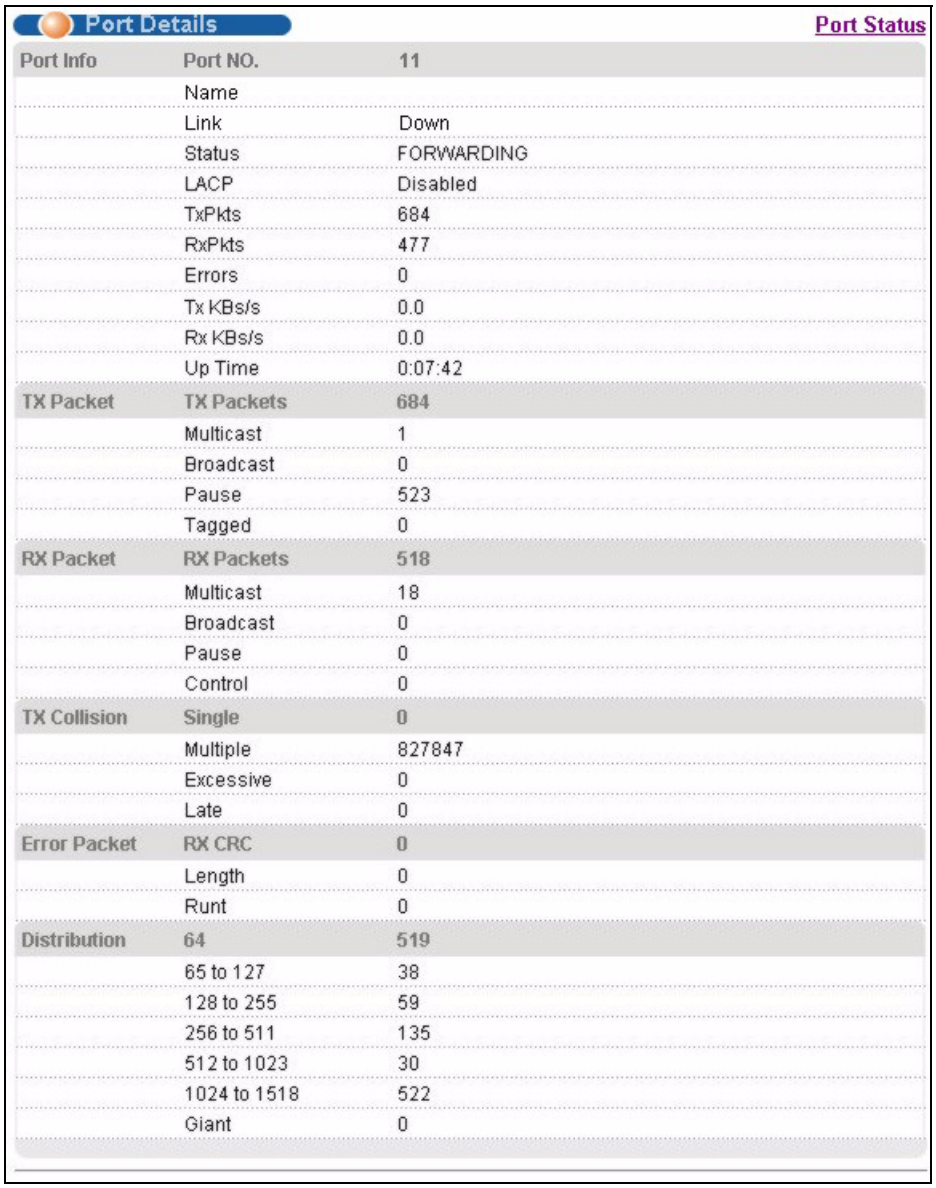
**Table 6** Status (continued)

| LABEL | DESCRIPTION |
|---|---|
| Tx KB/s | This field shows the number of kilobytes per second transmitted on this port. |
| Rx KB/s | This field shows the number of kilobytes per second received on this port. |
| Up Time | This field shows the total amount of time in hours, minutes and seconds the port has been up. |
| Clear Counter | Enter a port number and then click **Clear Counter** to erase the recorded statistical information for that port, or select **Any** to clear statistics for all ports. |

### 6.1.1 Status: Port Details

Click a number in the **Port** column in the **Status** screen to display individual port statistics. Use this screen to check status and detailed performance data about an individual port on the switch.

**Figure 26** Status: Port Details




The following table describes the labels in this screen.

**Table 7** Status: Port Details

| LABEL | DESCRIPTION |
|---|---|
| Port Info | |
| Name | This field shows the name of the port. |
| Link | This field shows whether the Ethernet connection is down, and the speed/duplex mode. It also shows the cable type (**Copper** or **Fiber**) for the combo ports. |
| Status | If STP (Spanning Tree Protocol) is enabled, this field displays the STP state of the port (see Section 11.1.3 on page 108 for more information).<br>If STP is disabled, this field displays FORWARDING if the link is up, otherwise, it displays STOP. |

**Table 7** Status: Port Details (continued)

| LABEL | DESCRIPTION |
|---|---|
| LACP | This field shows if LACP is enabled on this port or not. |
| TxPkts | This field shows the number of transmitted frames on this port |
| RxPkts | This field shows the number of received frames on this port |
| Errors | This field shows the number of received errors on this port. |
| Tx KB/s | This field shows the number kilobytes per second transmitted on this port. |
| Rx KB/s | This field shows the number of kilobytes per second received on this port. |
| Up Time | This field shows the total amount of time the connection has been up. |
| Tx Packet<br>The following fields display detailed information about packets transmitted. | |
| TX Packet | This field shows the number of good packets (unicast, multicast and broadcast) transmitted. |
| Multicast | This field shows the number of good multicast packets transmitted. |
| Broadcast | This field shows the number of good broadcast packets transmitted. |
| Pause | This field shows the number of 802.3x Pause packets transmitted. |
| Tagged | This field shows the number of packets with VLAN tags transmitted. |
| Rx Packet<br>The following fields display detailed information about packets received. | |
| RX Packet | This field shows the number of good packets (unicast, multicast and broadcast) received. |
| Multicast | This field shows the number of good multicast packets received. |
| Broadcast | This field shows the number of good broadcast packets received. |
| Pause | This field shows the number of 802.3x Pause packets received. |
| Control | This field shows the number of control received (including those with CRC error) but it does not include the 802.3x Pause frames. |
| TX Collision<br>The following fields display information on collisions while transmitting. | |
| Single | This is a count of successfully transmitted frames for which transmission is inhibited by exactly one collision. |
| Multiple | This is a count of successfully transmitted frames for which transmission was inhibited by more than one collision. |
| Excessive | This is a count of frames for which transmission failed due to excessive collisions. Excessive collision is defined as the number of maximum collisions before the retransmission count is reset. |
| Late | This is the number of times a late collision is detected, that is, after 512 bits of the frame have already been transmitted. |
| Error Packet | |
| RX CRC | This field shows the number of packets received with CRC (Cyclic Redundant Check) error(s). |
| Length | This field shows the number of frames received with a length that was out of range. |
| Runt | This field shows the number of packets received that were too short (shorter than 64 octets), including the ones with CRC errors. |
| Distribution | |

**Table 7** Status: Port Details (continued)

| LABEL | DESCRIPTION |
|---|---|
| 64 | This field shows the number of packets (including bad packets) received that were 64 octets in length. |
| 65-127 | This field shows the number of packets (including bad packets) received that were between 65 and 127 octets in length. |
| 128-255 | This field shows the number of packets (including bad packets) received that were between 128 and 255 octets in length. |
| 256-511 | This field shows the number of packets (including bad packets) received that were between 256 and 511 octets in length. |
| 512-1023 | This field shows the number of packets (including bad packets) received that were between 512 and 1023 octets in length. |
| 1024-1518 | This field shows the number of packets (including bad packets) received that were between 1024 and 1518 octets in length. |
| Giant | This field shows the number of packets dropped because they were bigger than the maximum frame size. |

# CHAPTER 7
# Basic Setting

This chapter describes how to configure the **System Info, General Setup**, **Switch Setup**, **IP Setup** and **Port Setup** screens.

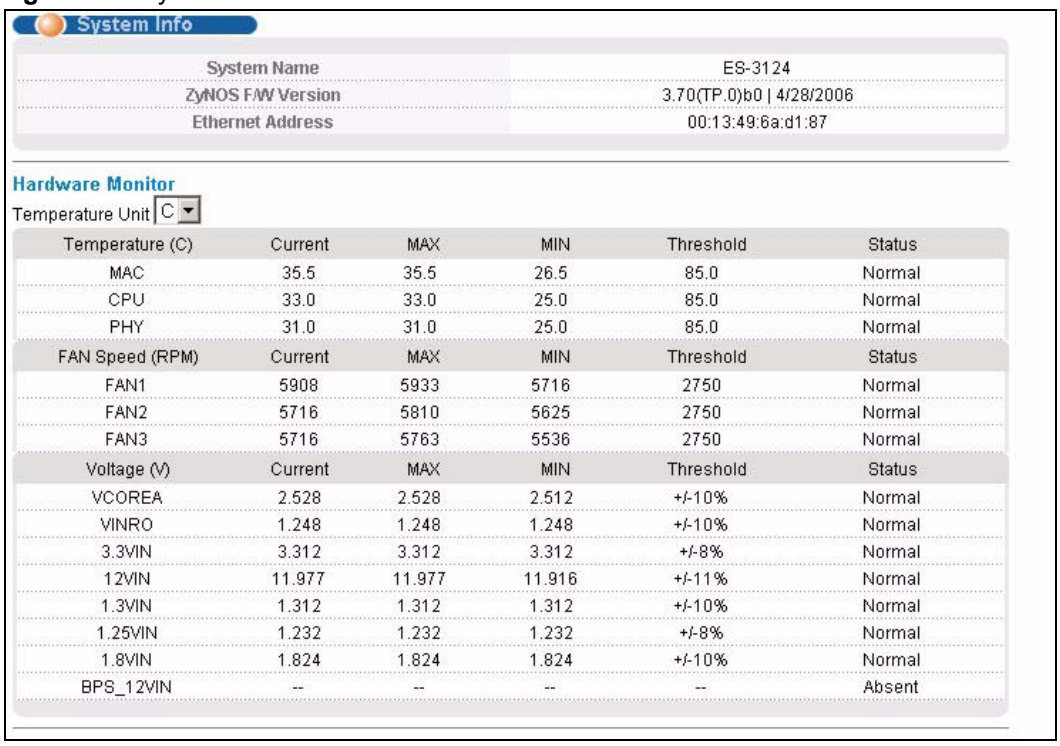
## 7.1 Overview

The **System Info** screen displays general switch information (such as firmware version number) and hardware polling information (such as fan speeds). The **General Setup** screen allows you to configure general switch identification information. The **General Setup** screen also allows you to set the system time manually or get the current time and date from an external server when you turn on your switch. The real time is then displayed in the switch logs. The **Switch Setup** screen allows you to set up and configure global switch features. The **IP Setup** screen allows you to configure a switch IP address, subnet mask(s) and DNS (domain name server) for management purposes.

## 7.2 System Information

In the navigation panel, click **Basic Setting** and **System Info** to display the screen as shown. You can check the firmware version number and monitor the switch temperature, fan speeds and voltage in this screen.

**Figure 27** System Info


System Info
System Name
ES-3124
ZyNOS F/W Version
3.70(TP.0)b0 | 4/28/2006
Ethernet Address
00:13:49:6a:d1:87
Hardware Monitor
Temperature Unit C
Temperature (C) Current MAX MIN Threshold Status
MAC 35.5 35.5 26.5 85.0 Normal
CPU 33.0 33.0 25.0 85.0 Normal
PHY 31.0 31.0 25.0 85.0 Normal
FAN Speed (RPM) Current MAX MIN Threshold Status
FAN1 5908 5933 5716 2750 Normal
FAN2 5716 5810 5625 2750 Normal
FAN3 5716 5763 5536 2750 Normal
Voltage (V) Current MAX MIN Threshold Status
VCOREA 2.528 2.528 2.512 +/-10% Normal
VINRO 1.248 1.248 1.248 +/-10% Normal
3.3VIN 3.312 3.312 3.312 +/-8% Normal
12VIN 11.977 11.977 11.916 +/-11% Normal
1.3VIN 1.312 1.312 1.312 +/-10% Normal
1.25VIN 1.232 1.232 1.232 +/-8% Normal
1.8VIN 1.824 1.824 1.824 +/-10% Normal
BPS_12VIN -- -- -- -- Absent

The following table describes the labels in this screen.

**Table 8** System Info

| LABEL | DESCRIPTION |
|---|---|
| System Name | This field displays the descriptive name of the switch for identification purposes. |
| ZyNOS F/W Version | This field displays the version number of the switch 's current firmware including the date created. |
| Ethernet Address | This field refers to the Ethernet MAC (Media Access Control) address of the switch. |
| Hardware Monitor | |
| Temperature Unit | The switch has temperature sensors that are capable of detecting and reporting if the temperature rises above the threshold. You may choose the temperature unit (Centigrade or Fahrenheit) in this field. |
| Temperature | **MAC**, **CPU** and **PHY** refer to the location of the temperature sensors on the switch printed circuit board. |
| Current | This field displays the current temperature measured at this sensor. |
| MAX | This field displays the maximum temperature measured at this sensor. |
| MIN | This field displays the minimum temperature measured at this sensor. |
| Threshold | This field displays the upper temperature limit at this sensor. |
| Status | This field displays **Normal** for temperatures below the threshold and **Error** for those above. |
| Fan speed (RPM) | A properly functioning fan is an essential component (along with a sufficiently ventilated, cool operating environment) in order for the device to stay within the temperature threshold. Each fan has a sensor that is capable of detecting and reporting if the fan speed falls below the threshold shown. |

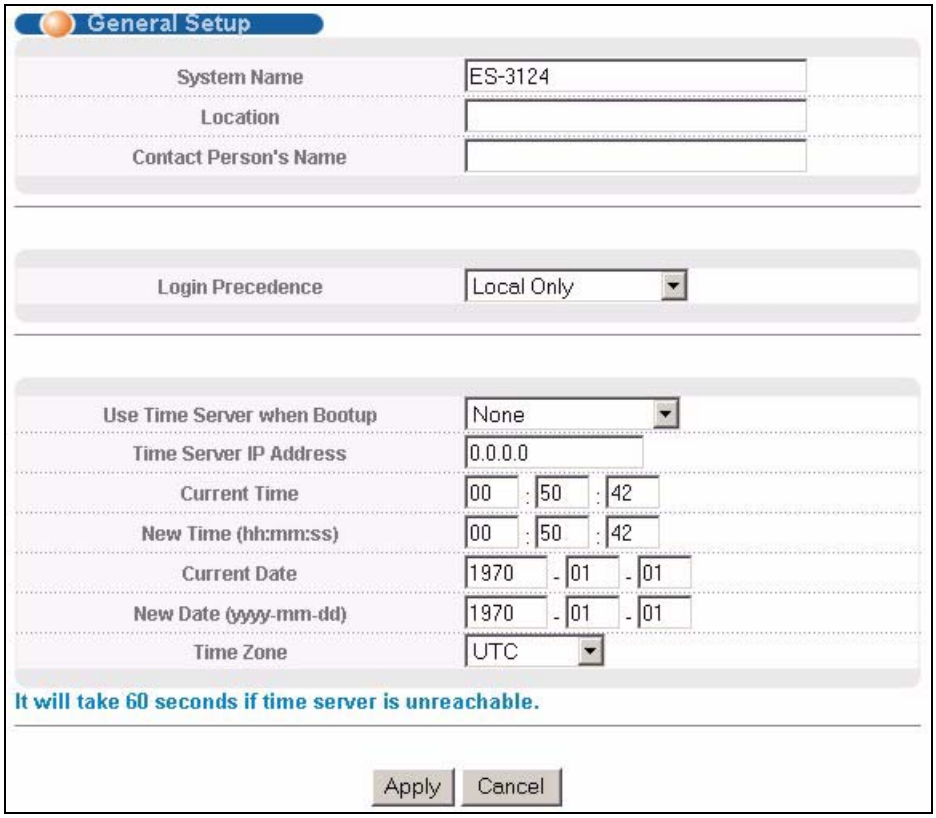
**Table 8** System Info (continued)

| LABEL | DESCRIPTION |
|---|---|
| Current | This field displays this fan's current speed in Revolutions Per Minute (RPM). |
| MAX | This field displays this fan's maximum speed measured in Revolutions Per Minute (RPM). |
| MIN | This field displays this fan's minimum speed measured in Revolutions Per Minute (RPM). "<41" is displayed for speeds too small to measure (under 2000 RPM). |
| Threshold | This field displays the minimum speed at which a normal fan should work. |
| Status | **Normal** indicates that this fan is functioning above the minimum speed. **Error** indicates that this fan is functioning below the minimum speed. |
| Voltage (V) | The power supply for each voltage has a sensor that is capable of detecting and reporting if the voltage falls out of the tolerance range. |
| Current | This is the current voltage reading. |
| MAX | This field displays the maximum voltage measured at this point. |
| MIN | This field displays the minimum voltage measured at this point. |
| Threshold | This field displays the minimum voltage at which the switch should work. |
| Status | **Normal** indicates that the voltage is within an acceptable operating range at this point; otherwise **Error** is displayed. |

## 7.3 General Setup

Use this screen to configure general settings such as the system name and time. Click **Basic Setting** and **General Setup** in the navigation panel to display the screen as shown.

**Figure 28** General Setup




The following table describes the labels in this screen.

**Table 9** General Setup

| LABEL | DESCRIPTION |
|---|---|
| System Name | Choose a descriptive name for identification purposes. This name consists of up to 64 printable characters; spaces are allowed. |
| Location | Enter the geographic location of your switch. You can use up to 32 printable ASCII characters; spaces are not allowed. |
| Contact Person's Name | Enter the name of the person in charge of this switch. You can use up to 32 printable ASCII characters; spaces are not allowed. |
| Login Precedence | Use this drop-down list box to select which database the switch should use (first) to authenticate an administrator (user for switch management).<br>Configure the local user accounts in the **Access Control Logins** screen. The RADIUS is an external server. Before you specify the priority, make sure you have set up the corresponding database correctly first.<br>Select **Local Only** to have the switch just check the administrator accounts configured in the **Access Control Logins** screen.<br>Select **Local then RADIUS** to have the switch check the administrator accounts configured in the **Access Control Logins** screen. If the user name is not found, the switch then checks the user database on the specified RADIUS server. You need to configure **Port Authentication Radius** first.<br>Select **RADIUS Only** to have the switch just check the user database on the specified RADIUS server for a login username, password and the access privilege. |

**Table 9** General Setup (continued)

| LABEL | DESCRIPTION |
|---|---|
| Use Time Server when Bootup | Enter the time service protocol that your timeserver uses. Not all time servers support all protocols, so you may have to use trial and error to find a protocol that works. The main differences between them are the time format.<br>When you select the **Daytime (RFC 867)** format, the switch displays the day, month, year and time with no time zone adjustment. When you use this format it is recommended that you use a Daytime timeserver within your geographical time zone.<br>**Time (RFC-868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0.<br>**NTP (RFC-1305)** is similar to Time (RFC-868).<br>**None** is the default value. Enter the time manually. Each time you turn on the switch, the time and date will be reset to 1970-1-1 0:0. |
| Time Server IP Address | Enter the IP address of your timeserver. The switch searches for the timeserver for up to 60 seconds. If you select a timeserver that is unreachable, then this screen will appear locked for 60 seconds. Please wait. |
| Current Time | This field displays the time you open this menu (or refresh the menu). |
| New Time (hh:min:ss) | Enter the new time in hour, minute and second format. The new time then appears in the **Current Time** field after you click **Apply**. |
| Current Date | This field displays the date you open this menu. |
| New Date (yyyy-mm-dd) | Enter the new date in year, month and day format. The new date then appears in the **Current Date** field after you click **Apply**. |
| Time Zone | Select the time difference between UTC (Universal Time Coordinated, formerly known as GMT, Greenwich Mean Time) and your time zone from the drop-down list box. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 7.4 Introduction to VLANs

A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same group(s); the traffic must first go through a router.

In MTU (Multi-Tenant Unit) applications, VLAN is vital in providing isolation and security among the subscribers. When properly configured, VLAN prevents one subscriber from accessing the network resources of another on the same LAN, thus a user will not see the printers and hard disks of another user in the same building.

VLAN also increases network performance by limiting broadcasts to a smaller and more manageable logical broadcast domain. In traditional switched environments, all broadcast packets go to each and every individual port. With VLAN, all broadcasts are confined to a specific broadcast domain.

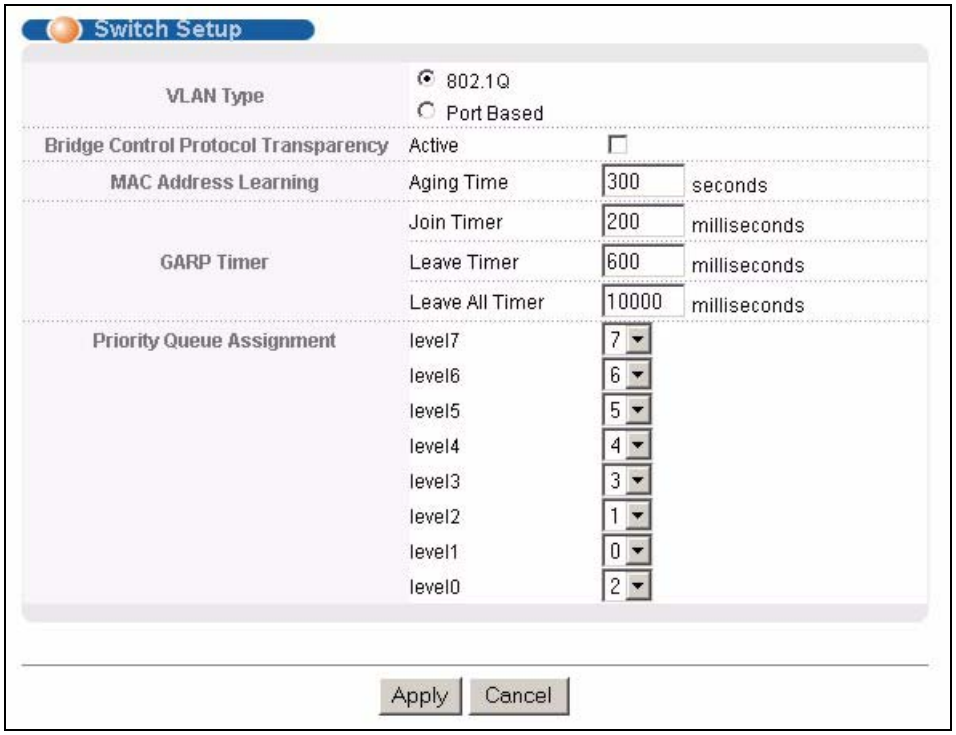
**Note:** VLAN is unidirectional; it only governs outgoing traffic.

See Chapter 8 on page 85 for information on port-based and 802.1Q tagged VLANs.

## 7.5 Switch Setup Screen

Click **Basic Setting** and then **Switch Setup** in the navigation panel to display the screen as shown. The VLAN setup screens change depending on whether you choose **802.1Q** or **Port Based** in the **VLAN Type** field in this screen. Refer to the chapter on VLAN.

**Figure 29** Switch Setup




The following table describes the labels in this screen.

**Table 10** Switch Setup

| LABEL | DESCRIPTION |
|---|---|
| VLAN Type | Choose **802.1Q** or **Port Based**. The **VLAN Setup** screen changes depending on whether you choose **802.1Q** VLAN type or **Port Based** VLAN type in this screen. See Chapter 8 on page 85 for more information. |
| Bridge Control Protocol Transparency | Select **Active** to allow the switch to handle bridging control protocols (STP for example). You also need to define how to treat a BPDU in the **Port Setup** screen. |
| MAC Address Learning | MAC address learning reduces outgoing traffic broadcasts. For MAC address learning to occur on a port, the port must be active. |

**Table 10** Switch Setup (continued)

| LABEL | DESCRIPTION |
|---|---|
| Aging Time | Enter a time from 10 to 3000 seconds. This is how long all dynamically learned MAC addresses remain in the MAC address table before they age out (and must be relearned). |
| GARP Timer: Switches join VLANs by making a declaration. A declaration is made by issuing a **Join** message using GARP. Declarations are withdrawn by issuing a **Leave** message. A **Leave All** message terminates all registrations. GARP timers set declaration timeout values. See the chapter on VLAN setup for more background information. | |
| Join Timer | Join Timer sets the duration of the Join Period timer for GVRP in milliseconds. Each port has a **Join Period** timer. The allowed **Join Time** range is between 100 and 65535 milliseconds; the default is 200 milliseconds. See the chapter on VLAN setup for more background information. |
| Leave Timer | Leave Time sets the duration of the **Leave Period** timer for GVRP in milliseconds. Each port has a single **Leave Period** timer. Leave Time must be two times larger than **Join Timer**; the default is 600 milliseconds. |
| Leave All Timer | Leave All Timer sets the duration of the Leave All Period timer for GVRP in milliseconds. Each port has a single Leave All Period timer. Leave All Timer must be larger than Leave Timer. |
| Priority Queue Assignment<br>IEEE 802.1p defines up to eight separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Frames without an explicit priority tag are given the default priority of the ingress port. Use the next two fields to configure the priority level-to-physical queue mapping.<br>The switch has eight physical queues that you can map to the 8 priority levels. On the switch, traffic assigned to higher index queues gets through faster while traffic in lower index queues is dropped if the network is congested. | |
| Priority Level (The following descriptions are based on the traffic types defined in the IEEE 802.1d standard (which incorporates the 802.1p). | |
| Level 7 | Typically used for network control traffic such as router configuration messages. |
| Level 6 | Typically used for voice traffic that is especially sensitive to jitter (jitter is the variations in delay). |
| Level 5 | Typically used for video that consumes high bandwidth and is sensitive to jitter. |
| Level 4 | Typically used for controlled load, latency-sensitive traffic such as SNA (Systems Network Architecture) transactions. |
| Level 3 | Typically used for "excellent effort" or better than best effort and would include important business traffic that can tolerate some delay. |
| Level 2 | This is for "spare bandwidth". |
| Level 1 | This is typically used for non-critical "background" traffic such as bulk transfers that are allowed but that should not affect other applications and users. |
| Level 0 | Typically used for best-effort traffic. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# 7.6 IP Setup

Use the **IP Setup** screen to configure the default gateway device, the default domain name server and add switch IP address.

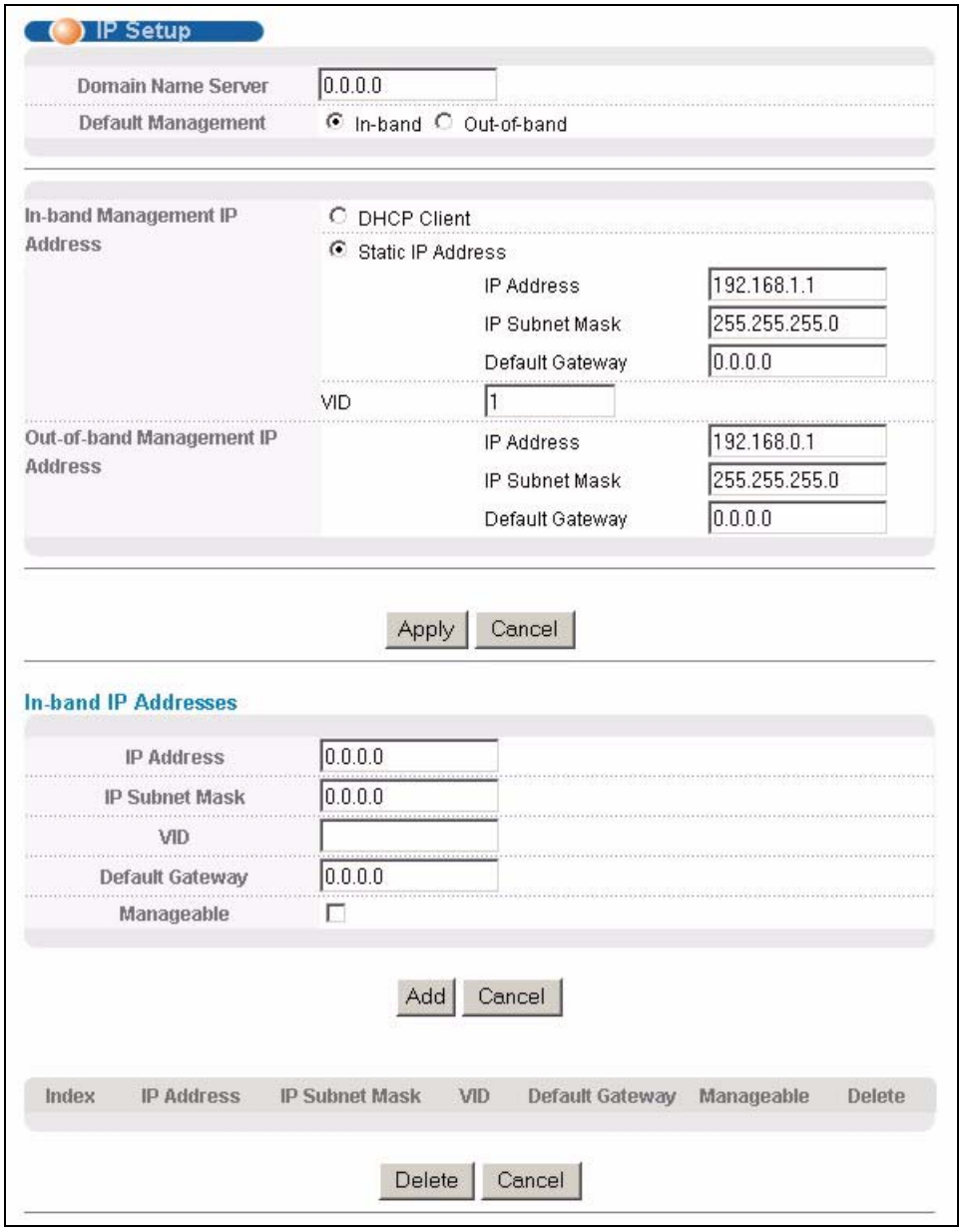
## 7.6.1 Management IP Addresses

The switch needs an IP address for it to be managed over the network. The factory default IP address is 192.168.1.1. The subnet mask specifies the network number portion of an IP address. The factory default subnet mask is 255.255.255.0.

You can configure up to 64 IP addresses which are used to access and manage the switch from the ports belonging to the pre-defined VLAN(s).

**Note:** You must configure a VLAN first.

**Figure 30** IP Setup



The following table describes the labels in this screen.

**Table 11** IP Setup

| LABEL | DESCRIPTION |
|---|---|
| Domain Name Server | DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. Enter a domain name server IP address in order to be able to use a domain name instead of an IP address. |
| Default Management | Specify which traffic flow (In-Band or Out-of-band) the switch is to send packets originating from itself (such as SNMP traps) or packets with unknown source.<br>Select **Out-of-band** to have the switch send the packets to the out-of-band management port. This means that device(s) connected to the other port(s) do not receive these packets.<br>Select **In-Band** to have the switch send the packets to all ports except the out-of-band management port to which connected device(s) do not receive these packets. |
| In-band Management IP Address | |
| DHCP Client | Select this option if you have a DHCP server that can assign the switch an IP address, subnet mask, a default gateway IP address and a domain name server IP address automatically. |
| Static IP Address | Select this option if you don't have a DHCP server or if you wish to assign static IP address information to the switch. You need to fill in the following fields when you select this option. |
| IP Address | Enter the IP address of your switch in dotted decimal notation for example 192.168.1.1. |
| IP Subnet Mask | Enter the IP subnet mask of your switch in dotted decimal notation for example 255.255.255.0. |
| Default Gateway | Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.1.254. |
| VID | Enter the VLAN identification number associated with the switch IP address. VID is the VLAN ID of the CPU and is used for management only. The default is "1". All ports, by default, are fixed members of this "management VLAN" in order to manage the device from any port. If a port is not a member of this VLAN, then users on that port cannot access the device. To access the switch make sure the port that you are connected to is a member of Management VLAN. |
| Out-of-band Management IP Address | |
| IP Address | Enter the IP address of your switch in dotted decimal notation for example 192.168.0.1.<br>If you change this IP address, make sure the computer connected to this management port is in the same subnet before accessing the switch. |
| IP Subnet Mask | Enter the IP subnet mask of your switch in dotted decimal notation for example 255.255.255.0. |
| Default Gateway | Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.0.254. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| In-band IP Addresses | You can create up to 64 IP addresses which are used to access and manage the switch from the ports belonging to the pre-defined VLAN(s). You must configure a VLAN first. |
| IP Address | Enter the IP address for managing the switch by the members of the VLAN specified in the **VID** field below. |

**Table 11** IP Setup (continued)

| LABEL | DESCRIPTION |
|---|---|
| IP Subnet Mask | Enter the IP subnet mask in dotted decimal notation. |
| VID | Type the VLAN group identification number. |
| Default Gateway | Enter the IP address of the default outgoing gateway in dotted decimal notation. |
| Manageable | Select this option to allow the switch to be managed using this specified IP address. |
| Add | Click **Add** to save the new rule to the switch's run-time memory. It then displays in the summary table at the bottom of the screen. |
| Cancel | Click **Cancel** to reset the fields. |
| Index | This field displays the index number of an entry. Click an index number to edit the rule. |
| IP Address | This field displays the IP address. |
| Subnet Mask | This field displays the subnet mask. |
| VID | This field displays the VLAN identification number of the network. |
| Default Gateway | This field displays the IP address of the default outgoing gateway. |
| Manageable | This field displays whether the switch can be managed using the specified IP address. |
| Delete | Click **Delete** to remove the selected entry from the summary table. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

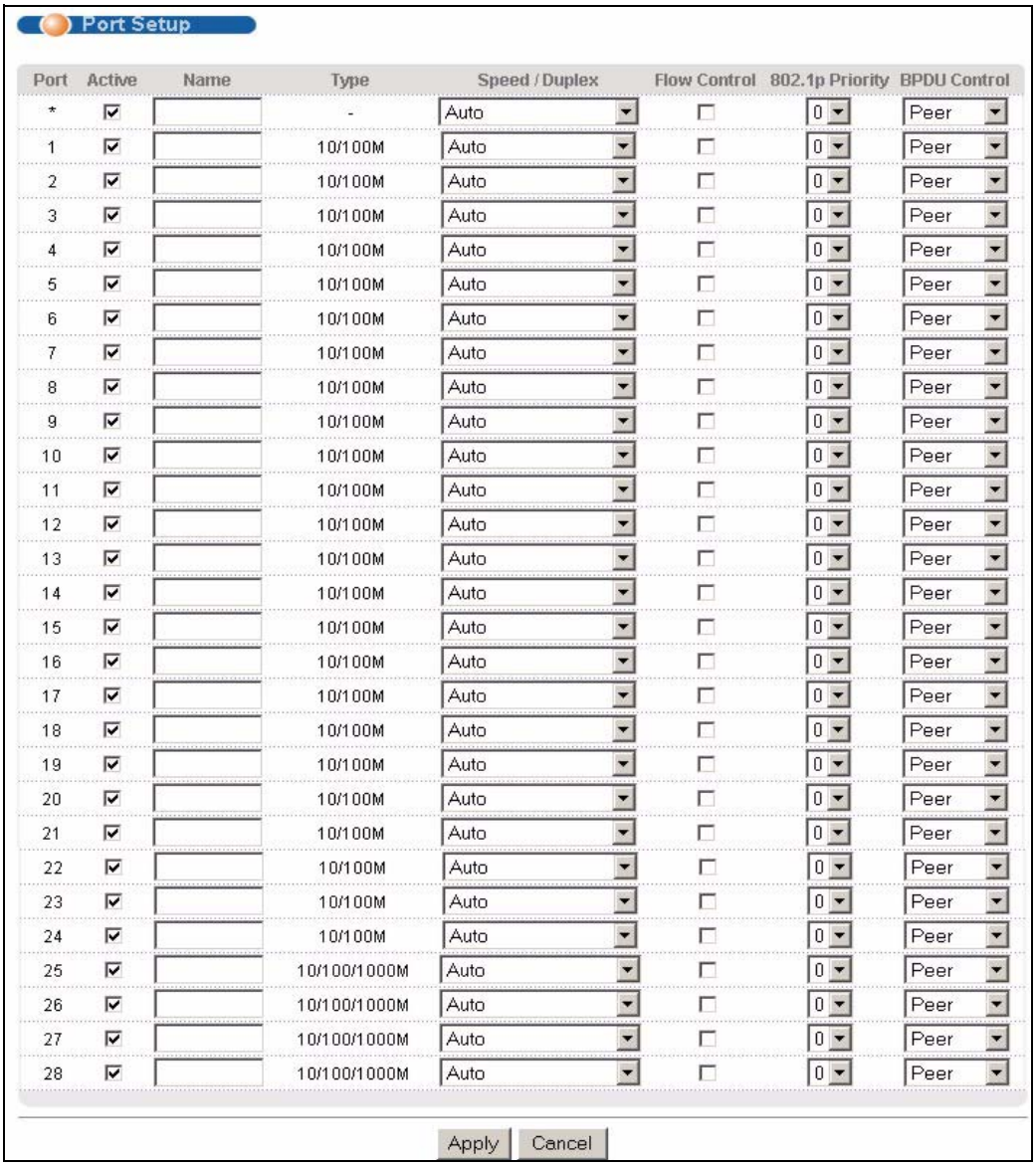
## 7.7 Port Setup

Use this screen to configure switch port settings. Click **Basic Setting** and then **Port Setup** in the navigation panel to enter the port configuration screen.

Full-duplex mode operation only applies to point-to-point access (for example, when attaching the switch to a workstation, server, or another switch). When connecting to hubs, use a standard cascaded connection set at half-duplex operation.

Auto-negotiation regulates the speed and duplex of each port, based on the capability of both devices. When auto-negotiation is turned on, an Ethernet port on the ZyXEL switch negotiates with the peer automatically to determine the connection speed and duplex mode. If the peer Ethernet port does not support auto-negotiation or turns off this feature, the ZyXEL switch determines the connection speed by detecting the signal on the cable and using half duplex mode. When the ZyXEL switch's auto-negotiation is turned off, an Ethernet port uses the preconfigured speed and duplex mode when making a connection, thus requiring you to make sure that the settings of the peer Ethernet port are the same in order to connect.

**Figure 31** Port Setup


Port Setup
Port Active Name Type Speed / Duplex Flow Control 802.1p Priority BPDU Control
* - Auto 0 Peer
1 10/100M Auto 0 Peer
2 10/100M Auto 0 Peer
3 10/100M Auto 0 Peer
4 10/100M Auto 0 Peer
5 10/100M Auto 0 Peer
6 10/100M Auto 0 Peer
7 10/100M Auto 0 Peer
8 10/100M Auto 0 Peer
9 10/100M Auto 0 Peer
10 10/100M Auto 0 Peer
11 10/100M Auto 0 Peer
12 10/100M Auto 0 Peer
13 10/100M Auto 0 Peer
14 10/100M Auto 0 Peer
15 10/100M Auto 0 Peer
16 10/100M Auto 0 Peer
17 10/100M Auto 0 Peer
18 10/100M Auto 0 Peer
19 10/100M Auto 0 Peer
20 10/100M Auto 0 Peer
21 10/100M Auto 0 Peer
22 10/100M Auto 0 Peer
23 10/100M Auto 0 Peer
24 10/100M Auto 0 Peer
25 10/100/1000M Auto 0 Peer
26 10/100/1000M Auto 0 Peer
27 10/100/1000M Auto 0 Peer
28 10/100/1000M Auto 0 Peer
Apply
Cancel

The following table describes the labels in this screen.

**Table 12** Port Setup

| LABEL | DESCRIPTION |
|---|---|
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Port | This is the port index number. |

**Table 12** Port Setup (continued)

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to enable a port. The factory default for all ports is enabled. A port must be enabled for data transmission to occur. |
| Name | Enter a descriptive name that identifies this port. |
| Type | This field displays **10/100M** for an Ethernet/Fast Ethernet connection and **10/100/1000M** for Gigabit connections. |
| Speed/Duplex | Select the speed and the duplex mode of the Ethernet connection on this port. Choices are **Auto**, **10M/Half Duplex**, **10M/Full Duplex**, **100M/Half Duplex**, **100M/Full Duplex** and **1000M/Full Duplex** (for Gigabit ports only).<br>Selecting **Auto** (auto-negotiation) allows one port to negotiate with a peer port automatically to obtain the connection speed and duplex mode that both ends support. When auto-negotiation is turned on, a port on the switch negotiates with the peer automatically to determine the connection speed and duplex mode. If the peer port does not support auto-negotiation or turns off this feature, the switch determines the connection speed by detecting the signal on the cable and using half duplex mode. When the switch's auto-negotiation is turned off, a port uses the pre-configured speed and duplex mode when making a connection, thus requiring you to make sure that the settings of the peer port are the same in order to connect. |
| Flow Control | A concentration of traffic on a port decreases port bandwidth and overflows buffer memory causing packet discards and frame losses. **Flow Control** is used to regulate transmission of signals to match the bandwidth of the receiving port.<br>The switch uses IEEE802.3x flow control in full duplex mode and backpressure flow control in half duplex mode.<br>IEEE802.3x flow control is used in full duplex mode to send a pause signal to the sending port, causing it to temporarily stop sending signals when the receiving port memory buffers fill.<br>Back Pressure flow control is typically used in half duplex mode to send a "collision" signal to the sending port (mimicking a state of packet collision) causing the sending port to temporarily stop sending signals and resend later. Select **Flow Control** to enable it. |
| 802.1p Priority | This priority value is added to incoming frames without a (802.1p) priority queue tag. See **Priority Queue Assignment** in Table 10 on page 76 for more information. |
| BPDU Control | Configure the way to treat BPDUs received on this port. You must activate bridging control protocol transparency in the **Switch Setup** screen first.<br>Select **Peer** to process any BPDU (Bridge Protocol Data Units) received on this port.<br>Select **Tunnel** to forward BPDUs received on this port.<br>Select **Discard** to drop any BPDU received on this port.<br>Select **Network** to process a BPDU with no VLAN tag and forward a tagged BPDU. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 8
# VLAN

The type of screen you see here depends on the **VLAN Type** you selected in the **Switch Setup** screen. This chapter shows you how to configure 802.1Q tagged and port-based VLANs.

## 8.1 Introduction to IEEE 802.1Q Tagged VLAN

A tagged VLAN uses an explicit tag (VLAN ID) in the MAC header to identify the VLAN membership of a frame across bridges - they are not confined to the switch on which they were created. The VLANs can be created statically by hand or dynamically through GVRP. The VLAN ID associates a frame with a specific VLAN and provides the information that switches need to process the frame across the network. A tagged frame is four bytes longer than an untagged frame and contains two bytes of TPID (Tag Protocol Identifier, residing within the type/length field of the Ethernet frame) and two bytes of TCI (Tag Control Information, starts after the source address field of the Ethernet frame).

The CFI (Canonical Format Indicator) is a single-bit flag, always set to zero for Ethernet switches. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be forwarded as it is to an untagged port. The remaining twelve bits define the VLAN ID, giving a possible maximum number of 4,096 (212) VLANs. Note that user priority and VLAN ID are independent of each other. A frame with VID (VLAN Identifier) of null (0) is called a priority frame, meaning that only the priority level is significant and the default VID of the ingress port is given as the VID of the frame. Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved, so the maximum possible VLAN configurations are 4,094.

| TPID | User Priority | CFI | VLAN ID |
|---|---|---|---|
| 2 Bytes | 3 Bits | 1 Bit | 12 bits |

### 8.1.1 Forwarding Tagged and Untagged Frames

Each port on the switch is capable of passing tagged or untagged frames. To forward a frame from an 802.1Q VLAN-aware switch to an 802.1Q VLAN-unaware switch, the switch first decides where to forward the frame and then strips off the VLAN tag. To forward a frame from an 802.1Q VLAN-unaware switch to an 802.1Q VLAN-aware switch, the switch first decides where to forward the frame, and then inserts a VLAN tag reflecting the ingress port's default VID. The default PVID is VLAN 1 for all ports, but this can be changed.

A broadcast frame (or a multicast frame for a multicast group that is known by the system) is duplicated only on ports that are members of the VID (except the ingress port itself), thus confining the broadcast to a specific domain.

# 8.2 Automatic VLAN Registration

GARP and GVRP are the protocols used to automatically register VLAN membership across switches.

## 8.2.1 GARP

GARP (Generic Attribute Registration Protocol) allows network switches to register and de-register attribute values with other GARP participants within a bridged LAN. GARP is a protocol that provides a generic mechanism for protocols that serve a more specific application, for example, GVRP.

### 8.2.1.1 GARP Timers

Switches join VLANs by making a declaration. A declaration is made by issuing a Join message using GARP. Declarations are withdrawn by issuing a Leave message. A Leave All message terminates all registrations. GARP timers set declaration timeout values.

## 8.2.2 GVRP

GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network. Enable this function to permit VLANs groups beyond the local switch.

Please refer to the following table for common IEEE 802.1Q VLAN terminology.

**Table 13** IEEE 802.1Q VLAN Terminology

| VLAN PARAMETER | TERM | DESCRIPTION |
|---|---|---|
| VLAN Type | Permanent VLAN | This is a static VLAN created manually. |
| | Dynamic VLAN | This is a VLAN configured by a GVRP registration/ deregistration process. |
| VLAN Administrative Control | Registration Fixed | Fixed registration ports are permanent VLAN members. |
| | Registration Forbidden | Ports with registration forbidden are forbidden to join the specified VLAN. |
| | Normal Registration | Ports dynamically join a VLAN using GVRP. |
| VLAN Tag Control | Tagged | Ports belonging to the specified VLAN tag all outgoing frames transmitted. |
| | Untagged | Ports belonging to the specified VLAN don't tag all outgoing frames transmitted. |

**Table 13** IEEE 802.1Q VLAN Terminology (continued)

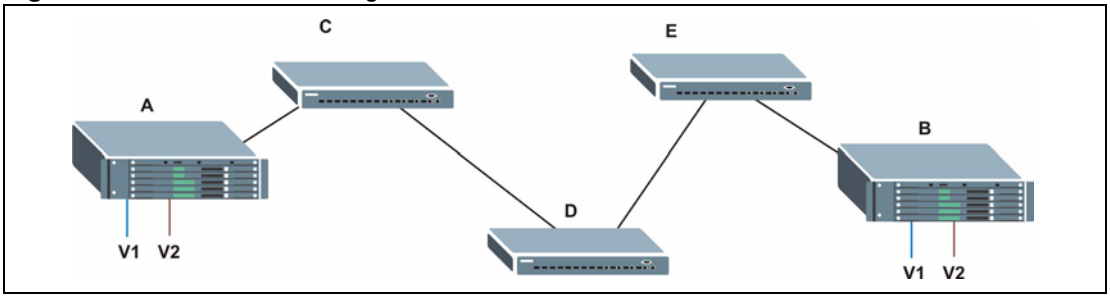
| VLAN PARAMETER | TERM | DESCRIPTION |
|---|---|---|
| VLAN Port | Port VID | This is the VLAN ID assigned to untagged frames that this port received. |
| | Acceptable Frame Type | You may choose to accept both tagged and untagged incoming frames, just tagged incoming frames or just untagged incoming frames on a port. |
| | Ingress filtering | If set, the switch discards incoming frames for VLANs that do not have this port as a member |

## 8.3 Port VLAN Trunking

Enable **VLAN Trunking** on a port to allow frames belonging to unknown VLAN groups to pass through that port. This is useful if you want to set up VLAN groups on end devices without having to configure the same VLAN groups on intermediary devices.

Refer to the following figure. Suppose you want to create VLAN groups 1 and 2 (V1 and V2) on devices A and B. Without **VLAN Trunking,** you must configure VLAN groups 1 and 2 on all intermediary switches C, D and E; otherwise they will drop frames with unknown VLAN group tags. However, with **VLAN Trunking** enabled on a port(s) in each intermediary switch you only need to create VLAN groups in the end devices (A and B). C, D and E automatically allow frames with VLAN group tags 1 and 2 (VLAN groups that are unknown to those switches) to pass through their VLAN trunking port(s).

**Figure 32** Port VLAN Trunking




## 8.4 Select the VLAN Type

1 Select a VLAN type in the **Switch Setup** screen.

**Figure 33** Switch Setup: Select VLAN Type

# 8.5 Static VLAN

Use a static VLAN to decide whether an incoming frame on a port should be

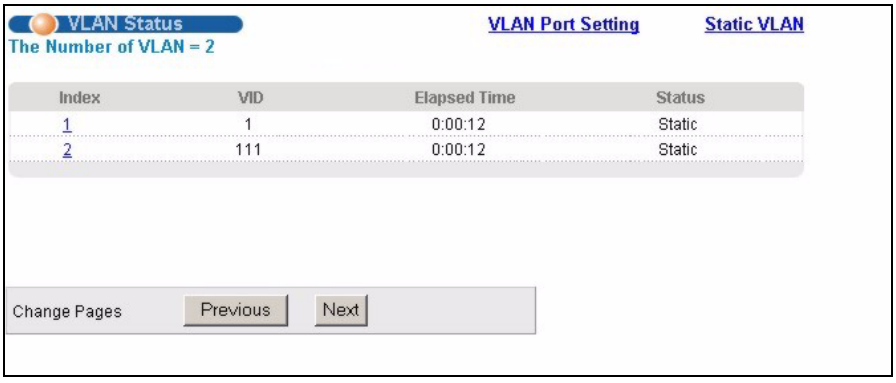
- sent to a VLAN group as normal depends on its VLAN tag.
- sent to a group whether it has a VLAN tag or not.
- blocked from a VLAN group regardless of its VLAN tag.

You can also tag all outgoing frames (that were previously untagged) from a port with the specified VID.

## 8.5.1 Static VLAN Status

See Section 8.1 on page 85 for more information on Static VLAN. Click **Advanced Application**, **VLAN** from the navigation panel to display the **VLAN Status** screen as shown next.

**Figure 34** VLAN: VLAN Status




The following table describes the labels in this screen.

**Table 14** VLAN: VLAN Status

| LABEL | DESCRIPTION |
|---|---|
| The Number of VLAN | This is the number of VLANs configured on the switch. |
| Index | This is the VLAN index number. Click on this to view port settings for the specified VLAN. |

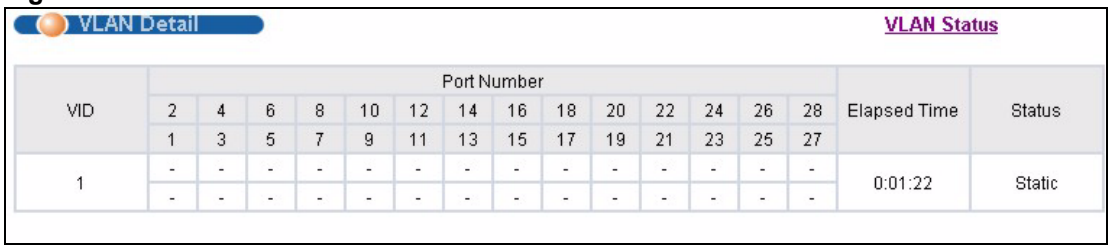
**Table 14** VLAN: VLAN Status (continued)

| LABEL | DESCRIPTION |
|---|---|
| VID | This is the VLAN identification number that was configured in the **Static VLAN** screen. |
| Elapsed Time | This field shows how long it has been since a normal VLAN was registered or a static VLAN was set up. |
| Status | This field shows how this VLAN was added to the switch; **dynamic** - using GVRP, **static** - added as a permanent entry or **other** - added using Multicast VLAN Registration (MVR). |
| Change Pages | Click **Previous** or **Next** to show the previous/next screen if all status information cannot be seen in one screen. |

## 8.5.2 Static VLAN Details

Use this screen to view detailed port settings and status of the VLAN group. See Section 8.5 on page 88 for more information on static VLAN. Click on an index number in the **VLAN Status** screen to display VLAN details.

**Figure 35** Static VLAN Details




The following table describes the labels in this screen.

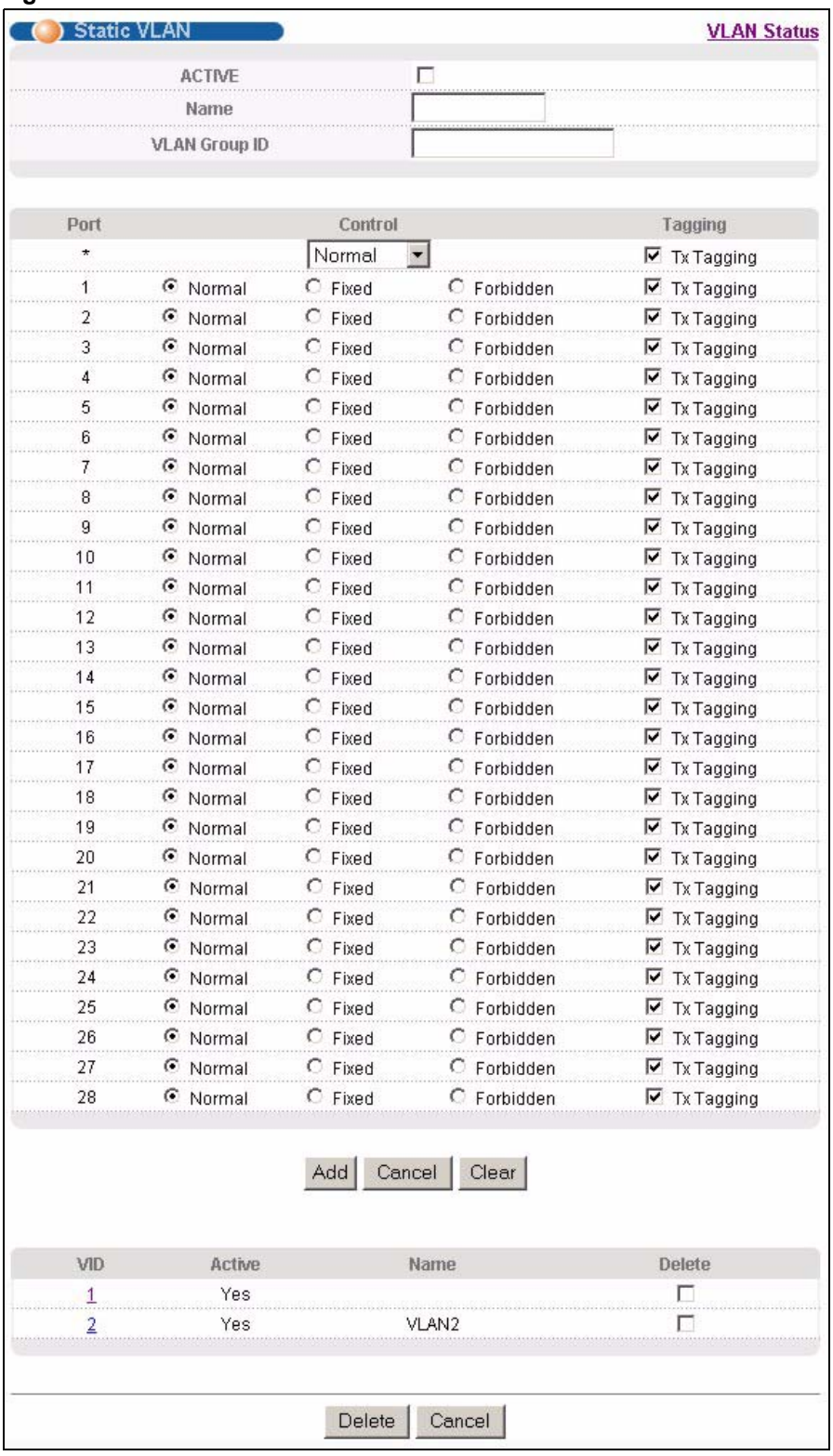
**Table 15** Static VLAN Details

| LABEL | DESCRIPTION |
|---|---|
| VLAN Status | Click this to go to the **VLAN Status** screen. |
| VID | This is the VLAN identification number that was configured in the **Static VLAN** screen. |
| Port Number | This column displays the ports that are participating in a VLAN. A tagged port is marked as **T**, an untagged port is marked as **U** and ports not participating in a VLAN are marked as "**–**". |
| Elapsed Time | This field shows how long it has been since a normal VLAN was registered or a static VLAN was set up. |
| Status | This field shows how this VLAN was added to the switch; **dynamic** - using GVRP, **static** - added as a permanent entry or **other** - added using Multicast VLAN Registration (MVR). |

### 8.5.3 Configure a Static VLAN

Use this screen to configure and view 802.1Q VLAN parameters for the switch. See Section 8.5 on page 88 for more information on static VLAN. To configure a static VLAN, click **Static VLAN** in the **VLAN Status** screen to display the screen as shown next.

**Figure 36** VLAN: Static VLAN


Static VLAN
VLAN Status
ACTIVE
Name
VLAN Group ID
Port
Control
Tagging
* Normal Tx Tagging
1 Normal Fixed Forbidden Tx Tagging
2 Normal Fixed Forbidden Tx Tagging
3 Normal Fixed Forbidden Tx Tagging
4 Normal Fixed Forbidden Tx Tagging
5 Normal Fixed Forbidden Tx Tagging
6 Normal Fixed Forbidden Tx Tagging
7 Normal Fixed Forbidden Tx Tagging
8 Normal Fixed Forbidden Tx Tagging
9 Normal Fixed Forbidden Tx Tagging
10 Normal Fixed Forbidden Tx Tagging
11 Normal Fixed Forbidden Tx Tagging
12 Normal Fixed Forbidden Tx Tagging
13 Normal Fixed Forbidden Tx Tagging
14 Normal Fixed Forbidden Tx Tagging
15 Normal Fixed Forbidden Tx Tagging
16 Normal Fixed Forbidden Tx Tagging
17 Normal Fixed Forbidden Tx Tagging
18 Normal Fixed Forbidden Tx Tagging
19 Normal Fixed Forbidden Tx Tagging
20 Normal Fixed Forbidden Tx Tagging
21 Normal Fixed Forbidden Tx Tagging
22 Normal Fixed Forbidden Tx Tagging
23 Normal Fixed Forbidden Tx Tagging
24 Normal Fixed Forbidden Tx Tagging
25 Normal Fixed Forbidden Tx Tagging
26 Normal Fixed Forbidden Tx Tagging
27 Normal Fixed Forbidden Tx Tagging
28 Normal Fixed Forbidden Tx Tagging
Add
Cancel
Clear
VID
Active
Name
Delete
1 Yes
2 Yes VLAN2
Delete
Cancel

The following table describes the related labels in this screen.

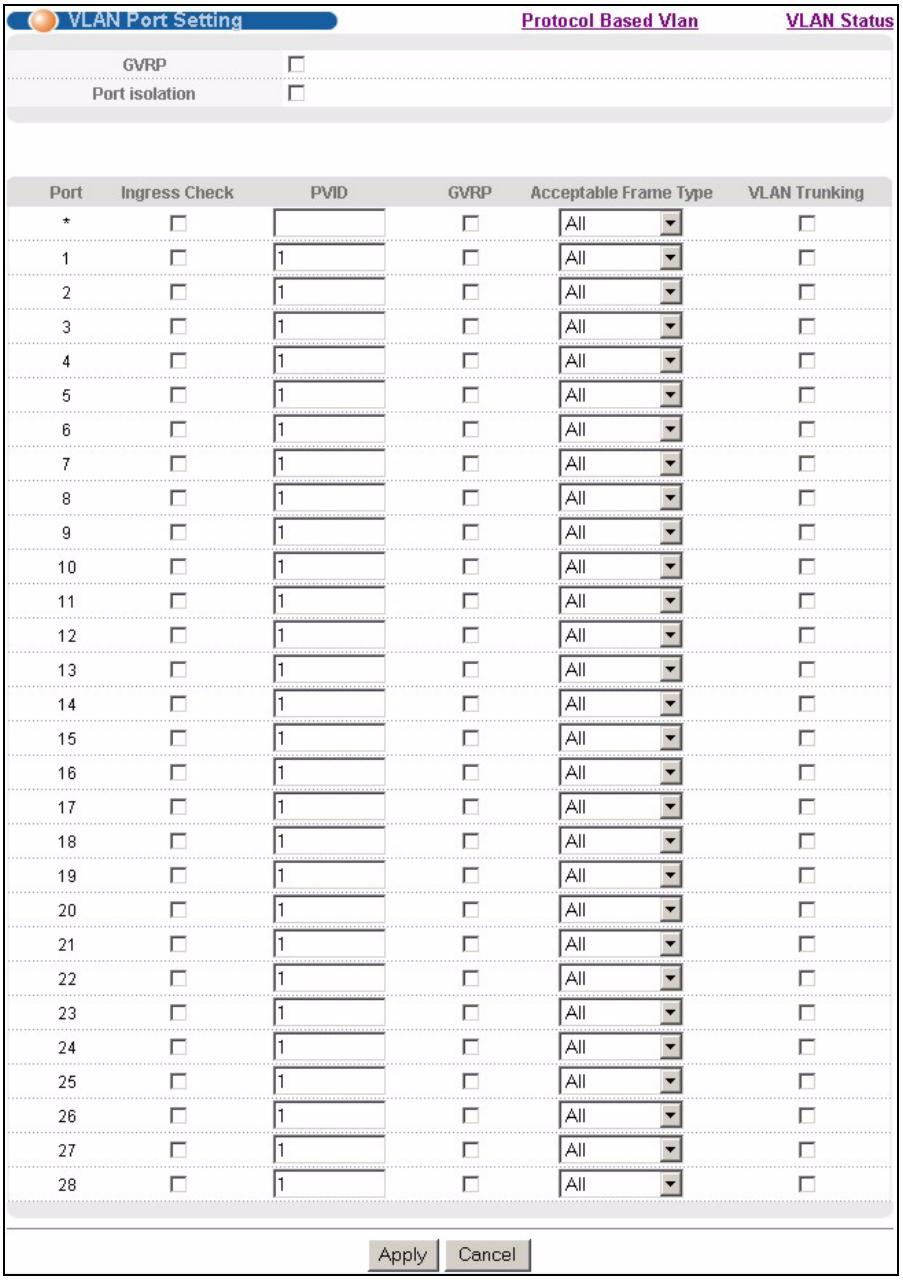
**Table 16** VLAN: Static VLAN

| LABEL | DESCRIPTION |
|---|---|
| ACTIVE | Select this check box to activate the VLAN settings. |
| Name | Enter a descriptive name for the VLAN group for identification purposes. |
| VLAN Group ID | Enter the VLAN ID for this static entry; the valid range is between 1 and 4094. |
| Port | The port number identifies the port you are configuring. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Control | Select **Normal** for the port to dynamically join this VLAN group using GVRP. This is the default selection.<br>Select **Fixed** for the port to be a permanent member of this VLAN group.<br>Select **Forbidden** if you want to prohibit the port from joining this VLAN group. |
| Tagging | Select **TX Tagging** if you want the port to tag all outgoing frames transmitted with this VLAN Group ID. |
| Add | Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Clear | Click **Clear** to start configuring the screen again. |
| VID | This field displays the ID number of the VLAN group. Click the number to edit the VLAN settings. |
| Active | This field indicates whether the VLAN settings are enabled (**Yes**) or disabled (**No**). |
| Name | This field displays the descriptive name for this VLAN group. |
| Delete | Click **Delete** to remove the selected entry from the summary table. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

## 8.5.4 Configure VLAN Port Settings

Use the VLAN Port Setting screen to configure the static VLAN (IEEE 802.1Q) settings on a port. See Section 8.5 on page 88 for more information on static VLAN. Click the **VLAN Port Setting** link in the **VLAN Status** screen.

**Figure 37** VLAN: VLAN Port Setting



The following table describes the labels in this screen.

**Table 17** VLAN: VLAN Port Setting

| LABEL | DESCRIPTION |
|---|---|
| GVRP | GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network.<br>Select this check box to permit VLAN groups beyond the local switch. |
| Port Isolation | **Port Isolation** allows each port to communicate only with the CPU management port but not communicate with each other. All incoming ports are selected while only the CPU outgoing port is selected. This option is the most limiting but also the most secure. |
| Port | This field displays the port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Ingress Check | If this check box is selected for a port, the device discards incoming frames for VLANs that do not include this port in its member set.<br>Clear this check box to disable ingress filtering. |
| PVID | Enter a number between 1and 4094 as the port VLAN ID. |
| GVRP | Select this check box to allow GVRP on this port. |
| Acceptable Frame Type | Specify the type of frames allowed on a port. Choices are **All**, **Tag Only** and **Untag Only**.<br>Select **All** from the drop-down list box to accept all untagged or tagged frames on this port. This is the default setting.<br>Select **Tag Only** to accept only tagged frames on this port. All untagged frames will be dropped.<br>Select **Untag Only** to accept only untagged frames on this port. All tagged frames will be dropped. |
| VLAN Trunking | Enable **VLAN Trunking** on ports connected to other switches or routers (but not ports directly connected to end users) to allow frames belonging to unknown VLAN groups to pass through the switch. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

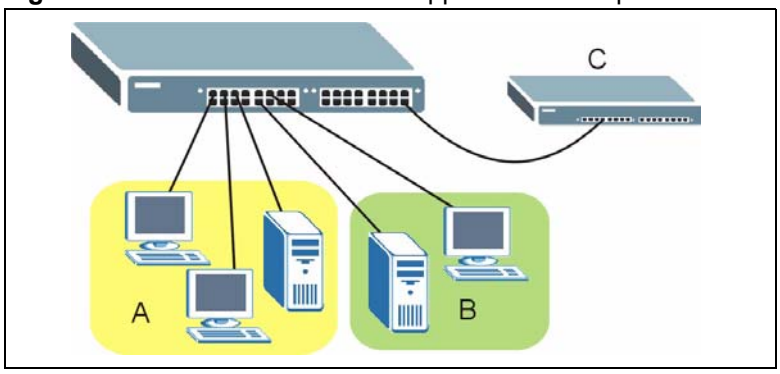
## 8.6 Protocol Based VLANs

Protocol based VLANs allow you to group traffic into logical VLANs based on the protocol you specify. When an upstream frame is received on a port (configured for a protocol based VLAN), the switch checks if a tag is added already and its protocol. The untagged packets of the same protocol are then placed in the same protocol based VLAN. One advantage of using protocol based VLANs is that priority can be assigned to traffic of the same protocol.

**Note:** Protocol based VLAN applies to un-tagged packets and is applicable only when you use IEEE 802.1Q tagged VLAN.

For example, port 1, 2, 3 and 4 belong to static VLAN 100, and port 4, 5, 10, 11 belong to static VLAN 120. You configure a protocol based VLAN A with priority 3 for ARP traffic received on port 1, 2 and 3. You also have a protocol based VLAN B with priority 2 for Apple Talk traffic received on port 10 and 11. All upstream ARP traffic from port 1, 2 and 3 will be grouped together, and all upstream Apple Talk traffic from port 10 and 11 will be in another group and have higher priority than ARP traffic, when they go through the uplink port to a backbone switch C.

**Figure 38** Protocol Based VLAN Application Example

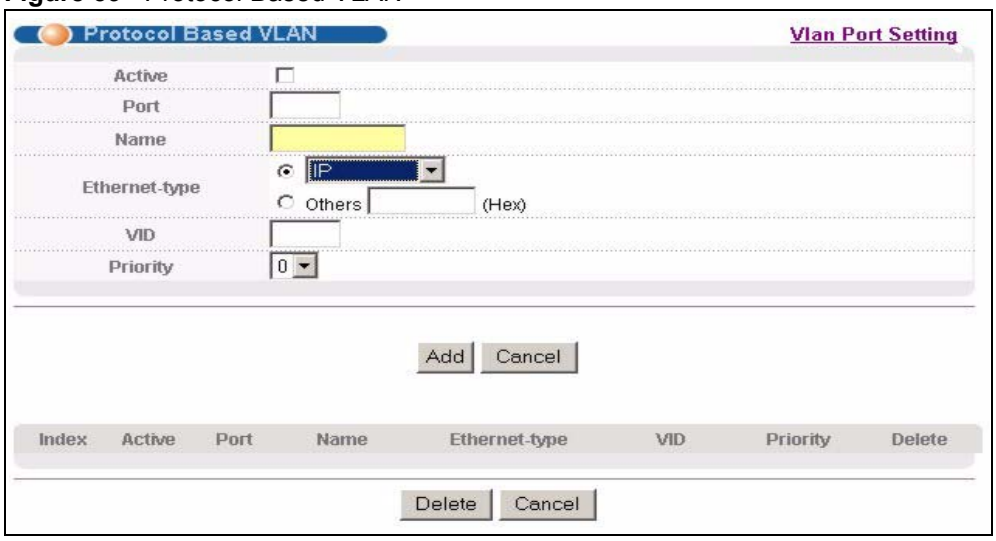



## 8.7 Configuring Protocol Based VLAN

Click **Advanced Applications, Protocol Based VLAN** in the navigation panel to display the configuration screen as shown.

**Note:** Protocol-based VLAN applies to un-tagged packets and is applicable only when you use IEEE 802.1Q tagged VLAN.

**Figure 39** Protocol Based VLAN




The following table describes the labels in this screen.

**Table 18** Protocol Based VLAN Setup

| LABEL | DESCRIPTION |
|---|---|
| Active | Check this box to activate this protocol based VLAN. |
| Port | Type a port to be included in this protocol based VLAN.<br>This port must belong to a static VLAN in order to participate in a protocol based VLAN. See Chapter 8 on page 85 for more details on setting up VLANs. |
| Name | Enter up to 11 alphanumeric characters to identify this protocol based VLAN. |
| Ethernet-type | Use the drop down list box to select a predefined protocol to be included in this protocol based VLAN or select **Others** and type the protocol number in hexadecimal notation. For example the IP protocol in hexadecimal notation is 0800, and Novell IPX protocol is 8137.<br>**Note:** Protocols in the hexadecimal number range of 0x0000 to 0x05ff are not allowed to be used for protocol based VLANs. |
| VID | Enter the ID of a VLAN to which the port belongs. This must be an existing VLAN which you defined in the **Advanced Applications**, **VLAN** screens. |
| Priority | Select the priority level that the switch will assign to frames belonging to this VLAN. |
| Add | Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Index | This is the index number identifying this protocol based VLAN. Click on any of these numbers to edit an existing protocol based VLAN. |
| Active | This field shows whether the protocol based VLAN is active or not. |
| Port | This field shows which port belongs to this protocol based VLAN. |
| Name | This field shows the name the protocol based VLAN. |
| Ethernet Type | This field shows which Ethernet protocol is part of this protocol based VLAN. |
| VID | This field shows the VLAN ID of the port. |

**Table 18** Protocol Based VLAN Setup (continued)

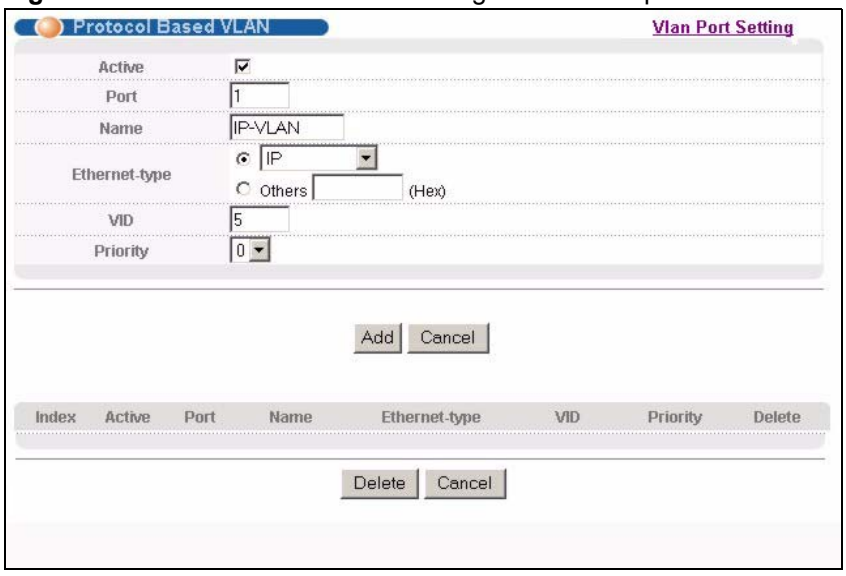
| LABEL | DESCRIPTION |
|---|---|
| Priority | This field shows the priority which is assigned to frames belonging to this protocol based VLAN. |
| Delete | Click this to delete the protocol based VLANs which you marked for deletion. |
| Cancel | Click **Cancel** to reset the fields. |

## 8.8 Create an IP-based VLAN Example

This example shows you how to create an IP VLAN which includes ports 1, 10 and 15. Follow these steps:

1. Activate this protocol based VLAN.
2. Type the port number you want to include in this protocol based VLAN. Type **1**.
3. Give this protocol-based VLAN a descriptive name. Type **IP-VLAN**.
4. Select the protocol. Leave the default value **IP**.
5. Type the VLAN ID of an existing VLAN. In our example we already created a static VLAN with an ID of 5. Type **5**.
6. Leave the priority set to **0** and click **Add**.

**Figure 40** Protocol Based VLAN Configuration Example




To add more ports to this protocol based VLAN.

1. Click the index number of the protocol based VLAN entry. Click **1**
2. Change the value in the **Port** field to the next port you want to add.
3. Click **Add**.

# 8.9 Port-based VLAN Setup

Port-based VLANs are VLANs where the packet forwarding decision is based on the destination MAC address and its associated port.

Port-based VLANs require allowed outgoing ports to be defined for each port. Therefore, if you wish to allow two subscriber ports to talk to each other, for example, between conference rooms in a hotel, you must define the egress (an egress port is an outgoing port, that is, a port through which a data packet leaves) for both ports.

Port-based VLANs are specific only to the switch on which they were created.

**Note:** When you activate port-based VLAN, the switch uses a default VLAN ID of 1. You cannot change it.

In screens (such as **IP Setup** and **Filtering**) that require a VID, you must enter 1 as the VID.

The port-based VLAN setup screen is shown next. The **CPU** management port forms a VLAN with all Ethernet ports.

## 8.9.1 Configure a Port-based VLAN

Select **Port Based** as the **VLAN Type** in the **Switch Setup** screen (see Figure 33 on page 88) and then click **VLAN** from the navigation panel to display the next screen.

**Figure 41** Port Based VLAN Setup (All Connected)

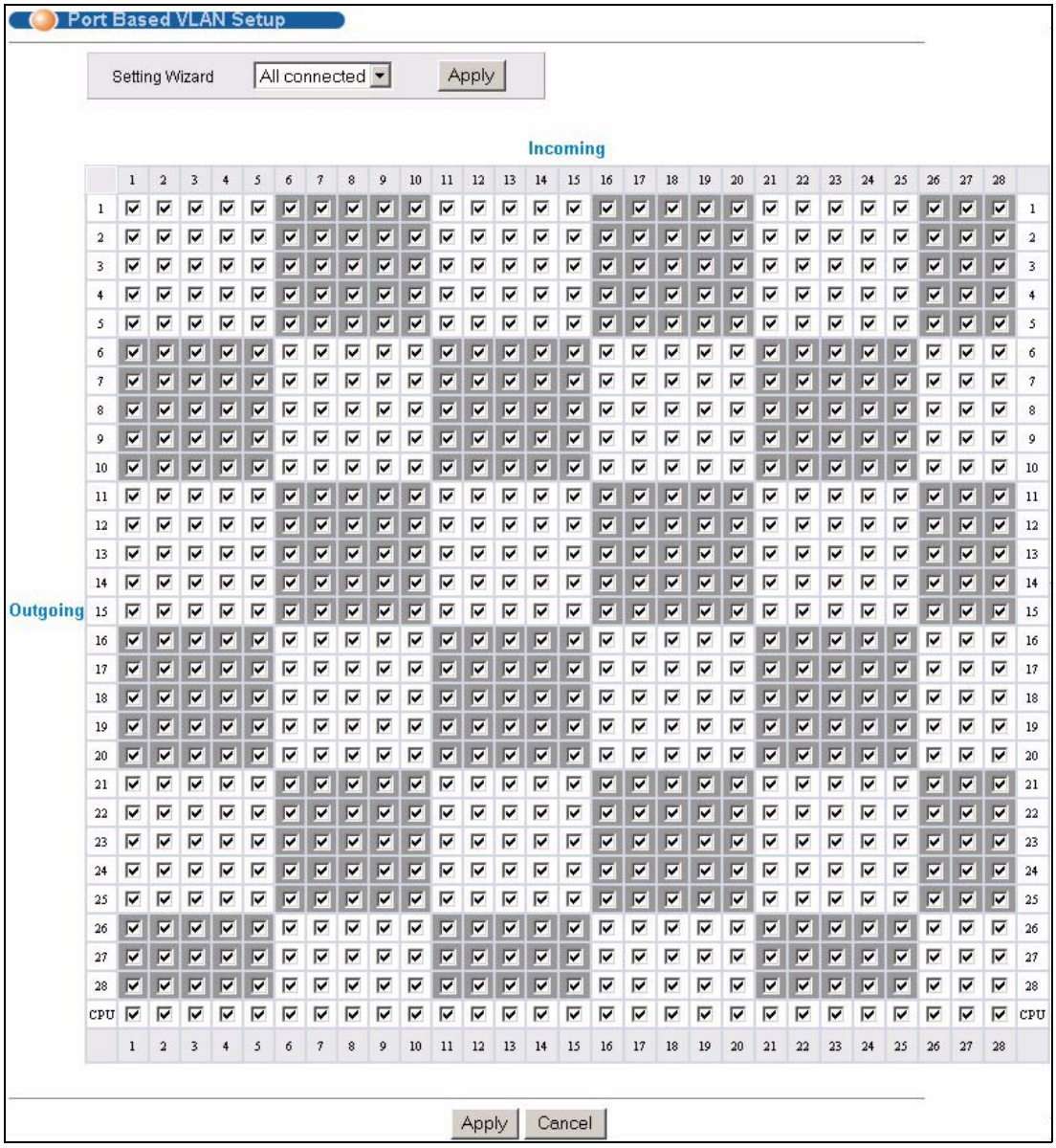
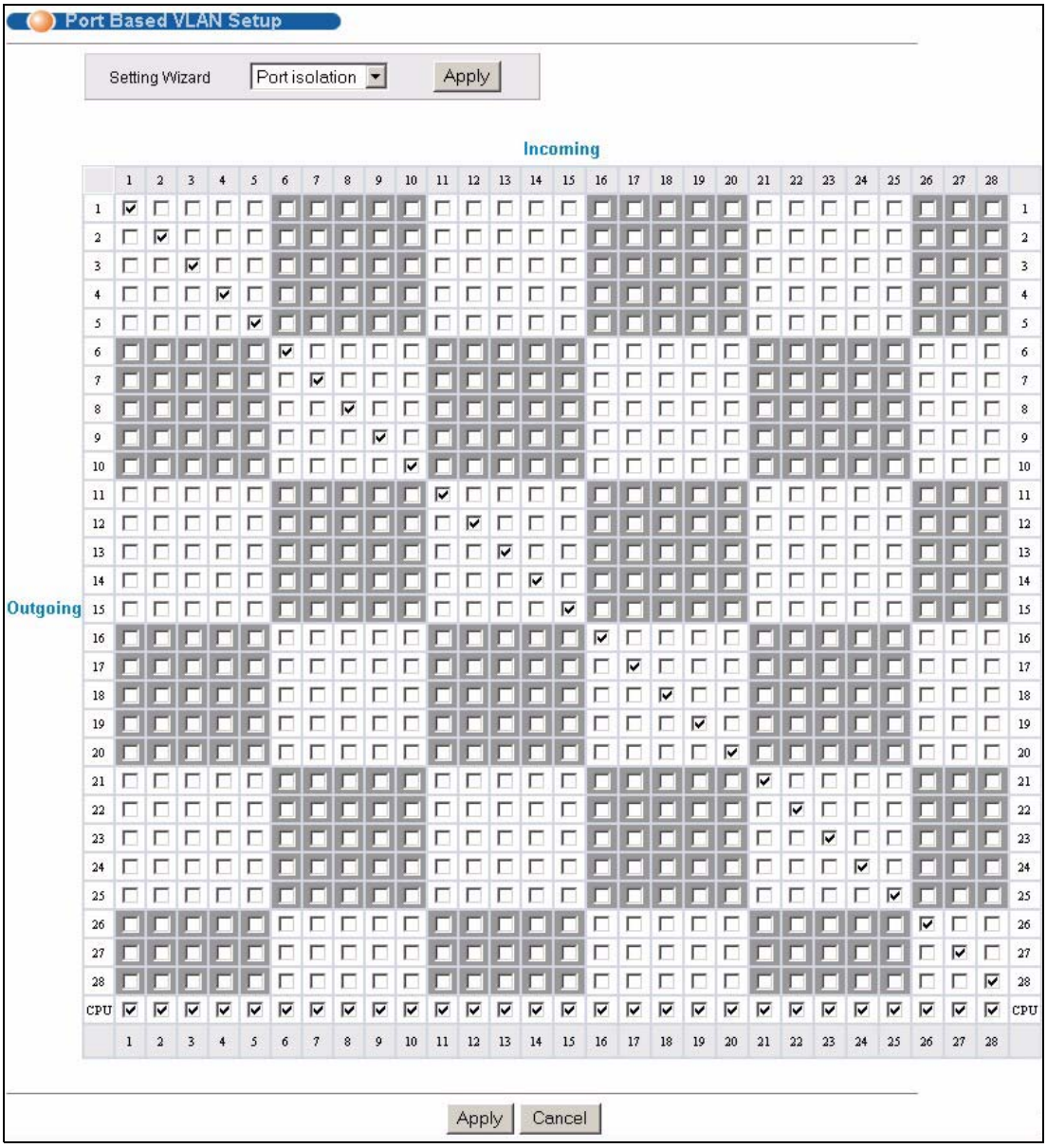

Port Based VLAN Setup
Setting Wizard
All connected
Apply
Incoming
Outgoing
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
CPU
Apply
Cancel

**Figure 42** Port Based VLAN Setup (Port Isolation)


Port Based VLAN Setup
Setting Wizard
Port isolation
Apply
Incoming
Outgoing
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
CPU
Apply
Cancel

The following table describes the labels in this screen.

**Table 19** Port Based VLAN Setup

| LABEL | DESCRIPTION |
|---|---|
| Setting Wizard | Choose **All connected** or **Port isolation**.<br>**All connected** means all ports can communicate with each other, that is, there are no virtual LANs. All incoming and outgoing ports are selected. This option is the most flexible but also the least secure.<br>**Port isolation** means that each port can only communicate with the CPU management port and cannot communicate with each other. All incoming ports are selected while only the CPU outgoing port is selected. This option is the most limiting but also the most secure.<br>After you make your selection, click **Apply** (top right of screen) to display the screens as mentioned above. You can still customize these settings by adding/deleting incoming or outgoing ports, but you must also click **Apply** at the bottom of the screen. |
| Incoming | These are the ingress ports; an ingress port is an incoming port, that is, a port through which a data packet enters. If you wish to allow two subscriber ports to talk to each other, you must define the ingress port for both ports. The numbers in the top row denote the incoming port for the corresponding port listed on the left (its outgoing port). **CPU** refers to the switch management port. By default it forms a VLAN with all Ethernet ports. If it does not form a VLAN with a particular port then the switch cannot be managed from that port. |
| Outgoing | These are the egress ports; an egress port is an outgoing port, that is, a port through which a data packet leaves. If you wish to allow two subscriber ports to talk to each other, you must define the egress port for both ports. **CPU** refers to the switch management port. By default it forms a VLAN with all Ethernet ports. If it does not form a VLAN with a particular port then the switch cannot be managed from that port. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 9
# Static MAC Forwarding

Use these screens to configure static MAC address forwarding.

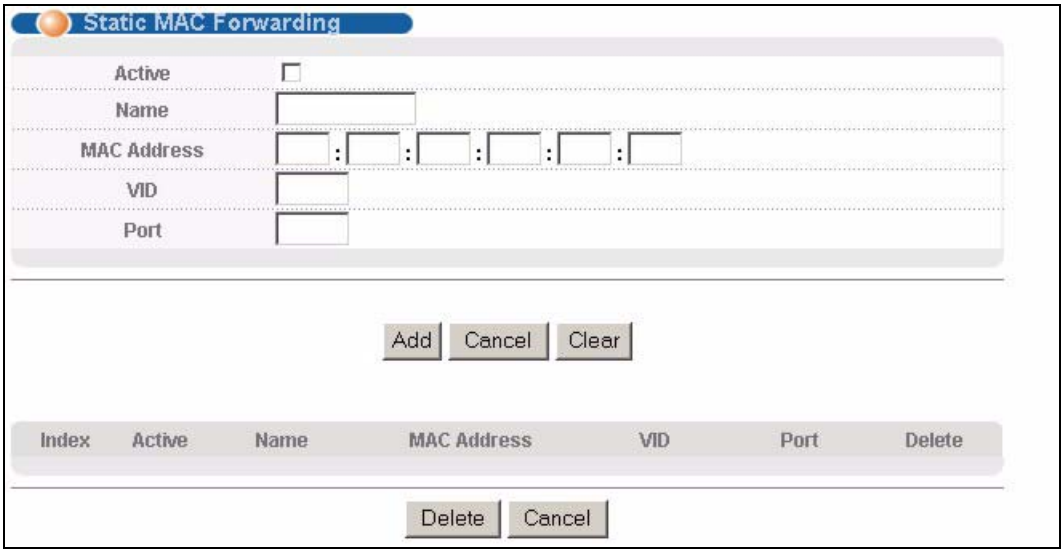
## 9.1 Configuring Static MAC Forwarding

A static MAC address is an address that has been manually entered in the MAC address table. Static MAC addresses do not age out. When you set up static MAC address rules, you are setting static MAC addresses for a port. This may reduce the need for broadcasting.

Static MAC address forwarding together with port security allow only computers in the MAC address table on a port to access the switch. See Chapter 17 on page 143 for more information on port security.

Click **Advanced Applications, Static MAC Forwarding** in the navigation panel to display the configuration screen as shown.

**Figure 43** Static MAC Forwarding



The following table describes the labels in this screen.

**Table 20** Static MAC Forwarding

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to activate your rule. You may temporarily deactivate a rule without deleting it by clearing this check box. |
| Name | Enter a descriptive name for identification purposes for this static MAC address forwarding rule. |
| MAC Address | Enter the MAC address in valid MAC address format, that is, six hexadecimal character pairs.<br><br>**Note:** Static MAC addresses do not age out. |
| VID | Enter the VLAN identification number. |
| Port | Enter the port where the MAC address entered in the previous field will be automatically forwarded. |
| Add | Click **Apply** to save your rule to the the switch's run-time memory. The switch loses this rule if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Clear | Click **Clear** to begin configuring this screen afresh. |
| Index | Click an index number to modify a static MAC address rule for a port. |
| Active | This field displays whether this static MAC address forwarding rule is active (**Yes**) or not (**No**). You may temporarily deactivate a rule without deleting it. |
| Name | This field displays the descriptive name for identification purposes for this static MAC address-forwarding rule. |
| MAC Address | This field displays the MAC address that will be forwarded and the VLAN identification number to which the MAC address belongs. |
| VID | This field displays the ID number of the VLAN group. |
| Port | This field displays the port where the MAC address shown in the next field will be forwarded. |
| Delete | Click **Delete** to remove the selected entry from the summary table. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

# CHAPTER 10
# Filtering

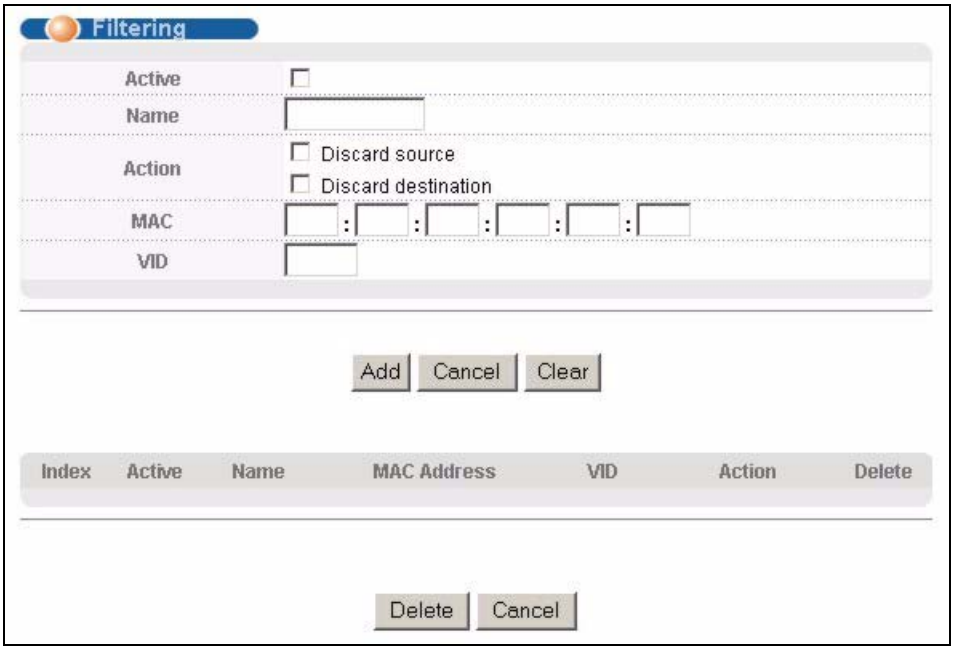
This chapter discusses static IP and MAC address port filtering.

## 10.1 Configure a Filtering Rule

Filtering means sifting traffic going through the switch based on the source and/or destination MAC addresses and VLAN group (ID).

Click **Advanced Application** and **Filtering** in the navigation panel to display the screen as shown next.

**Figure 44** Filtering




The following table describes the related labels in this screen.

**Table 21** FIltering

| LABEL | DESCRIPTION |
|---|---|
| Active | Make sure to select this check box to activate your rule. You may temporarily deactivate a rule without deleting it by deselecting this check box. |
| Name | Type a descriptive name (up to 32 printable ASCII characters) for this rule. This is for identification purpose only. |

**Table 21** FIltering (continued)

| LABEL | DESCRIPTION |
|---|---|
| Action | Select **Discard source** to drop frame from the source MAC address (specified in the **MAC** field). The switch can still send frames to the MAC address.<br>Select **Discard destination** to drop frames to the destination MAC address (specified in the **MAC** address). The switch can still receive frames originating from the MAC address.<br>Select **Discard source** and **Discard destination** to block traffic to/from the MAC address specified in the **MAC** field. |
| MAC | Type a MAC address in valid MAC address format, that is, six hexadecimal character pairs. |
| VID | Type the VLAN group identification number. |
| Add | Click **Add** to save this rule to the the switch's run-time memory. The switch loses this rule if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Clear | Click **Clear** to clear the fields to the factory defaults. |
| Index | This field displays the index number of the rule. Click an index number to change the settings. |
| Active | This field displays **Yes** when the rule is activated and **No** when is it deactivated. |
| Name | This field displays the descriptive name for this rule. This is for identification purpose only. |
| MAC Address | This field displays the source/destination MAC address with the VLAN identification number to which the MAC address belongs. |
| VID | This field displays the VLAN identification number. |
| Action | This field displays the filtering action (**Discard both**, **Discard source** or **Discard dest.**). |
| Delete | Check the rule(s) that you want to remove in the **Delete** column and then click the **Delete** button. |
| Cancel | Click **Cancel** to clear the selected checkbox(es) in the **Delete** column. |

# CHAPTER 11
# Spanning Tree Protocol

The switch supports Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP) as defined in the following standards.

- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1w Rapid Spanning Tree Protocol

The switch also allows you to set up multiple STP configurations (or trees). Ports can then be assigned to the trees.

## 11.1 STP/RSTP Overview

(R)STP detects and breaks network loops and provides backup links between switches, bridges or routers. It allows a switch to interact with other (R)STP -compliant switches in your network to ensure that only one path exists between any two stations on the network.

The switch uses IEEE 802.1w RSTP (Rapid Spanning Tree Protocol) that allows faster convergence of the spanning tree than STP (while also being backwards compatible with STP-only aware bridges). In RSTP, topology change information is directly propagated throughout the network from the device that generates the topology change. In STP, a longer delay is required as the device that causes a topology change first notifies the root bridge that then notifies the network. Both RSTP and STP flush unwanted learned addresses from the filtering database. In RSTP, the port states are Discarding, Learning, and Forwarding.

**Note:** In this user's guide, "STP" refers to both STP and RSTP.

### 11.1.1 STP Terminology

The root bridge is the base of the spanning tree; it is the bridge with the lowest identifier value (MAC address).

Path cost is the cost of transmitting a frame onto a LAN through that port. It is assigned according to the speed of the link to which a port is attached. The slower the media, the higher the cost.

**Table 22** STP Path Costs

| | LINK SPEED | RECOMMENDED VALUE | RECOMMENDED RANGE | ALLOWED RANGE |
|---|---|---|---|---|
| Path Cost | 4Mbps | 250 | 100 to 1000 | 1 to 65535 |
| Path Cost | 10Mbps | 100 | 50 to 600 | 1 to 65535 |

**Table 22** STP Path Costs

| | LINK SPEED | RECOMMENDED VALUE | RECOMMENDED RANGE | ALLOWED RANGE |
|---|---|---|---|---|
| Path Cost | 16Mbps | 62 | 40 to 400 | 1 to 65535 |
| Path Cost | 100Mbps | 19 | 10 to 60 | 1 to 65535 |
| Path Cost | 1Gbps | 4 | 3 to 10 | 1 to 65535 |
| Path Cost | 10Gbps | 2 | 1 to 5 | 1 to 65535 |

On each bridge, the root port is the port through which this bridge communicates with the root. It is the port on this switch with the lowest path cost to the root (the root path cost). If there is no root port, then this switch has been accepted as the root bridge of the spanning tree network.

For each LAN segment, a designated bridge is selected. This bridge has the lowest cost to the root among the bridges connected to the LAN.

## 11.1.2 How STP Works

After a bridge determines the lowest cost-spanning tree with STP, it enables the root port and the ports that are the designated ports for connected LANs, and disables all other ports that participate in STP. Network packets are therefore only forwarded between enabled ports, eliminating any possible network loops.

STP-aware switches exchange Bridge Protocol Data Units (BPDUs) periodically. When the bridged LAN topology changes, a new spanning tree is constructed.

Once a stable network topology has been established, all bridges listen for Hello BPDUs (Bridge Protocol Data Units) transmitted from the root bridge. If a bridge does not get a Hello BPDU after a predefined interval (Max Age), the bridge assumes that the link to the root bridge is down. This bridge then initiates negotiations with other bridges to reconfigure the network to re-establish a valid network topology.

## 11.1.3 STP Port States

STP assigns five port states to eliminate packet looping. A bridge port is not allowed to go directly from blocking state to forwarding state so as to eliminate transient loops.

**Table 23** STP Port States

| PORT STATE | DESCRIPTION |
|---|---|
| Disabled | STP is disabled (default). |
| Blocking | Only configuration and management BPDUs are received and processed. |
| Listening | All BPDUs are received and processed. |

**Table 23** STP Port States

| PORT STATE | DESCRIPTION |
|---|---|
| Learning | All BPDUs are received and processed. Information frames are submitted to the learning process but not forwarded. |
| Forwarding | All BPDUs are received and processed. All information frames are received and forwarded. |

### 11.1.4 Multiple RSTP

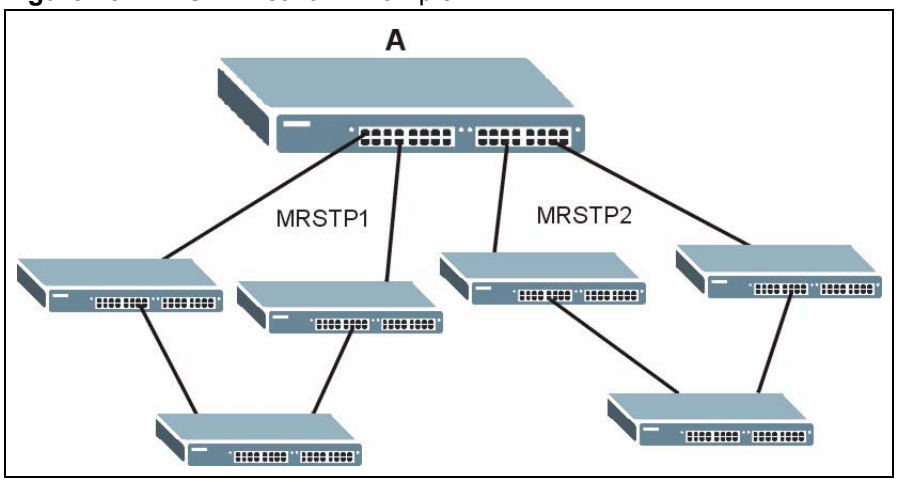
MRSTP (Multiple RSTP) is ZyXEL's proprietary feature that is compatible with RSTP and STP. With MRSTP, you can have more than one spanning tree on your switch and assign port(s) to each tree. Each spanning tree operates independently with its own bridge information.

In the following example, there are two RSTP instances (**MRSTP 1** and **MRSTP2**) on switch **A**.

To set up MRSTP, activate MRSTP on the switch and specify which port(s) belong to which spanning tree.

**Note:** Each port can belong to one STP tree only.

**Figure 45** MRSTP Network Example




## 11.2 Spanning Tree Protocol Main Screen

The switch allows you to configure a single RSTP configuration or you can configure multiple configurations. Click **Advanced Application**, **Spanning Tree Protocol** in the navigation panel to choose whether you want to configure multiple or a single Spanning Tree Protocol configuration.

**Note:** This screen is only available if neither RSTP or MRSTP is active. Once you select RSTP or MRSTP this screen displays the status of your configuration.

**Figure 46** Spanning Tree Protocol RSTP and MRSTP

The following table describes the labels in this screen.

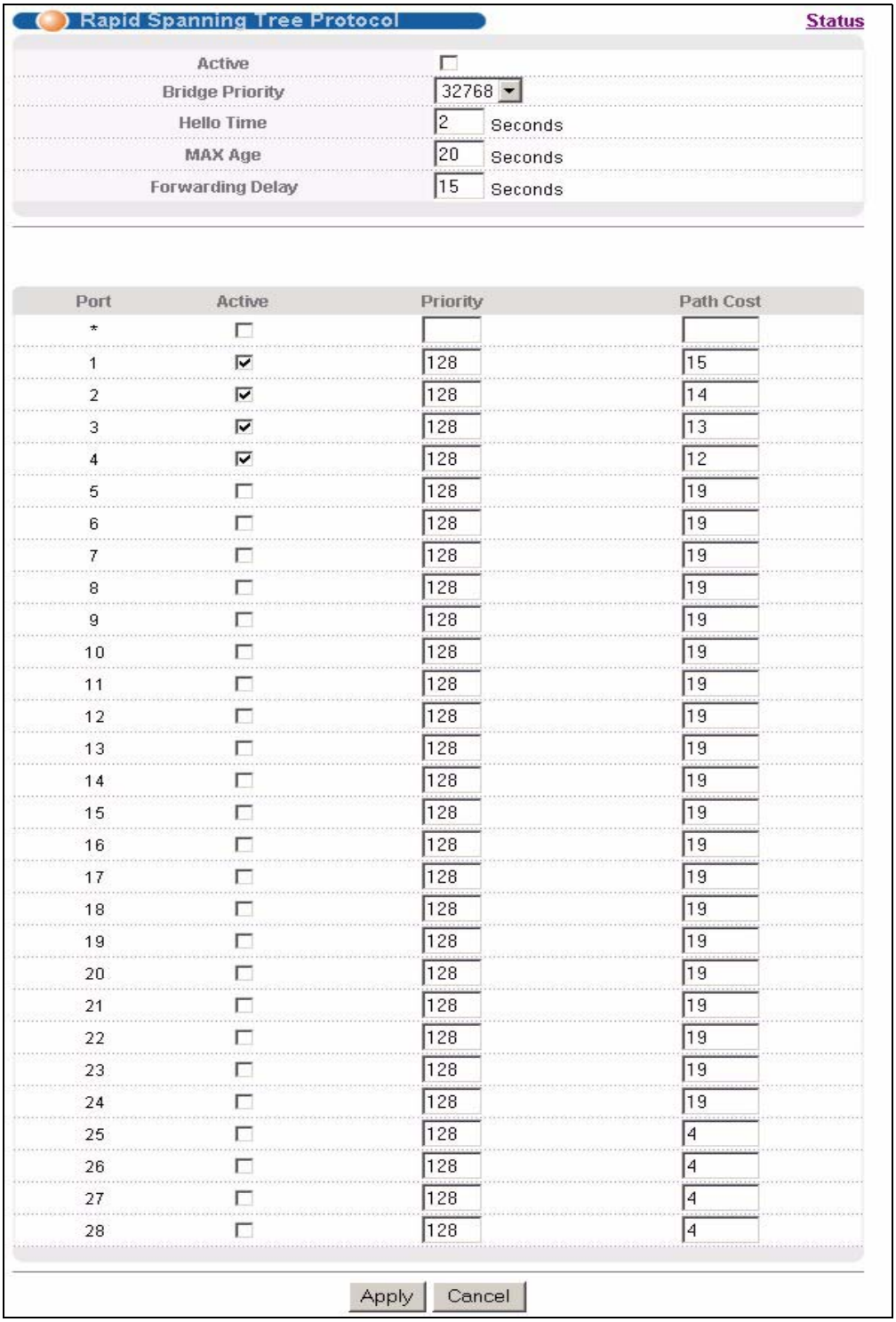
**Table 24** Spanning Tree Protocol: Status

| LABEL | DESCRIPTION |
|---|---|
| RSTP | This link takes you to the Rapid Spanning Tree Protocol configuration screen. See Section 11.3 on page 110. |
| MRSTP | This link takes you to the Multiple Rapid Spanning Tree Protocol configuration screen. See Section 11.3 on page 110. |

## 11.3 Configure Rapid Spanning Tree Protocol

Use this screen to configure RSTP settings, see Section 11.1 on page 107 for more information on RSTP. Click **RSTP** in the **Advanced Application**, **Spanning Tree Protocol** screen.

**Figure 47** RSTP: Configuration



The following table describes the labels in this screen.

**Table 25** RSTP: Configuration

| LABEL | DESCRIPTION |
|---|---|
| Status | Click **Status** to display the **RSTP Status** screen (see Figure 48 on page 113). |
| Active | Select this check box to activate RSTP. Clear this checkbox to disable RSTP. |
| Bridge Priority | Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Select a value from the drop-down list box.<br>The lower the numeric value you assign, the higher the priority for this bridge.<br>Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay. |
| Hello Time | This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds. |
| Max Age | This is the maximum time (in seconds) a switch can wait without receiving a BPDU before attempting to reconfigure. All switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the switch ports attached to the network. The allowed range is 6 to 40 seconds. |
| Forwarding Delay | This is the maximum time (in seconds) a switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds.<br>As a general rule:<br>**Note:** 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1) |
| Port | This field displays the port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Active | Select this check box to activate RSTP on this port. |
| Priority | Configure the priority for each port here.<br>Priority decides which port should be disabled when more than one port forms a loop in a switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255 and the default value is 128. |
| Path Cost | Path cost is the cost of transmitting a frame on to a LAN through that port. It is assigned according to the speed of the bridge. The slower the media, the higher the cost - see Table 22 on page 107 for more information. |

**Table 25** RSTP: Configuration (continued)

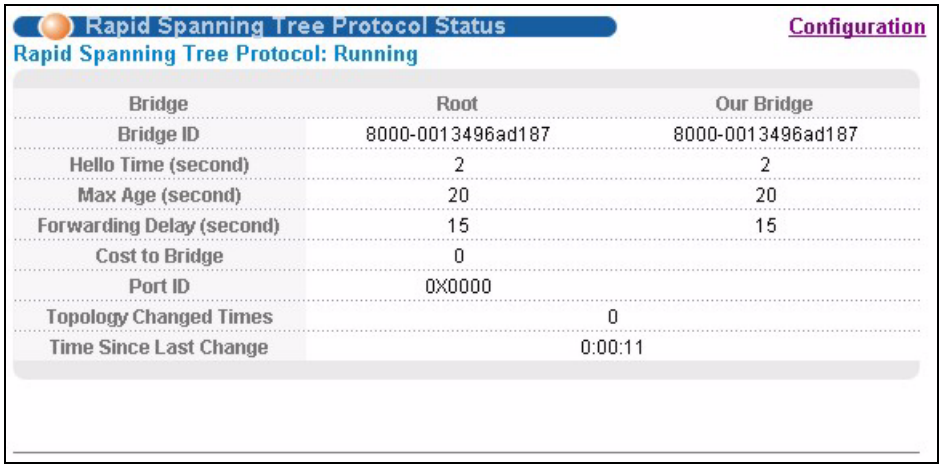
| LABEL | DESCRIPTION |
|---|---|
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# 11.4 Rapid Spanning Tree Protocol Status

Click **Advanced Application**, **Spanning Tree Protocol** in the navigation panel to display the status screen as shown next. See Section 11.1 on page 107 for more information on RSTP.

**Note:** This screen is only available after you activate RSTP on the switch.

**Figure 48** Rapid Spanning Tree Protocol: Status




The following table describes the labels in this screen.

**Table 26** Rapid Spanning Tree Protocol: Status

| LABEL | DESCRIPTION |
|---|---|
| Configuration | Click **Configuration** to configure RSTP settings. Refer to Section 11.3 on page 110. |
| Bridge | **Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this switch. This switch may also be the root bridge. |
| Bridge ID | This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the switch is the root switch. |
| Hello Time (second) | This is the time interval (in seconds) at which the root switch transmits a configuration message. The root bridge determines **Hello Time**, **Max Age** and **Forwarding Delay** |

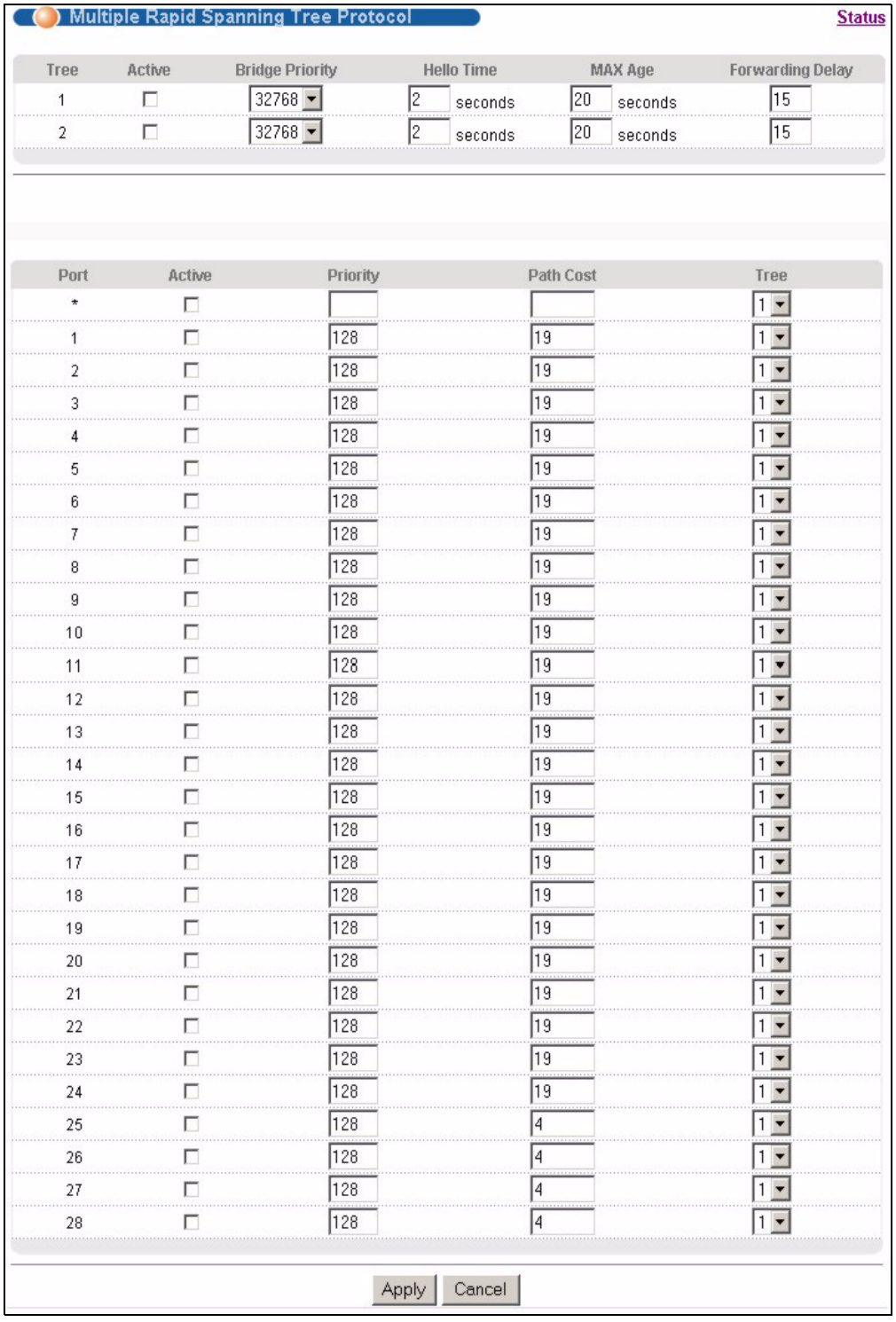
**Table 26** Rapid Spanning Tree Protocol: Status (continued)

| LABEL | DESCRIPTION |
|---|---|
| Max Age (second) | This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure. |
| Forwarding Delay (second) | This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding). |
| Cost to Bridge | This is the path cost from the root port on this switch to the root switch. |
| Port ID | This is the priority and number of the port on the switch through which this switch must communicate with the root of the Spanning Tree. |
| Topology Changed Times | This is the number of times the spanning tree has been reconfigured. |
| Time Since Last Change | This is the time since the spanning tree was last reconfigured. |

## 11.5 Configure Multiple Rapid Spanning Tree Protocol

To configure MRSTP, select **MRSTP** in the **Advanced Application**, **Spanning Tree Protocol** screen. See Section 11.1 on page 107 for more information on MRSTP.

**Figure 49** MRSTP: Configuration



The following table describes the labels in this screen.

**Table 27** MRSTP: Configuration

| LABEL | DESCRIPTION |
|---|---|
| Status | Click **Status** to display the **MRSTP Status** screen (see Figure 48 on page 113). |
| Tree | This is a read only index number of the STP trees. |
| Active | Select this check box to activate an STP tree. Clear this checkbox to disable an STP tree. |
| Bridge Priority | Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Select a value from the drop-down list box.<br>The lower the numeric value you assign, the higher the priority for this bridge.<br>Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay. |
| Hello Time | This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds. |
| Max Age | This is the maximum time (in seconds) a switch can wait without receiving a BPDU before attempting to reconfigure. All switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the switch ports attached to the network. The allowed range is 6 to 40 seconds. |
| Forwarding Delay | This is the maximum time (in seconds) a switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds.<br>As a general rule:<br>**Note:** 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1) |
| Port | This field displays the port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Active | Select this check box to activate STP on this port. |
| Priority | Configure the priority for each port here.<br>Priority decides which port should be disabled when more than one port forms a loop in a switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255 and the default value is 128. |
| Path Cost | Path cost is the cost of transmitting a frame on to a LAN through that port. It is assigned according to the speed of the bridge. The slower the media, the higher the cost - see Table 22 on page 107 for more information. |
| Tree | Select which STP tree configuration this port should participate in. |

**Table 27** MRSTP: Configuration (continued)

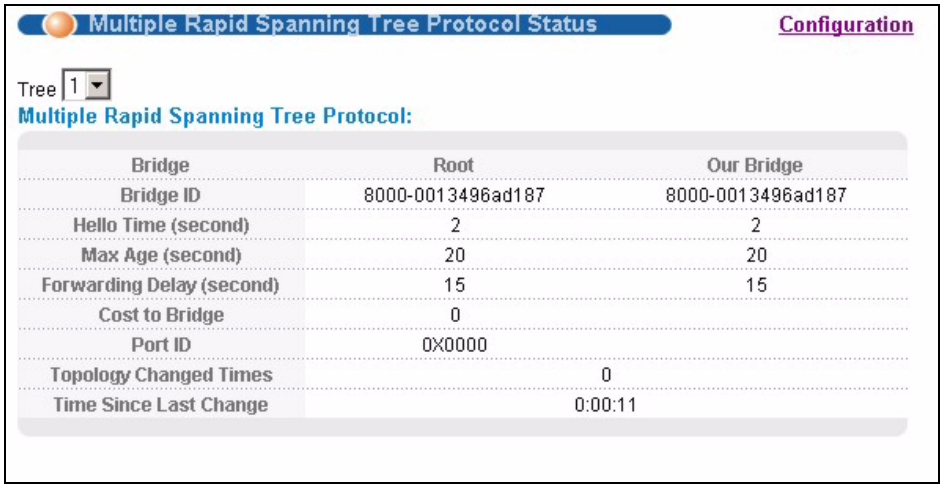
| LABEL | DESCRIPTION |
|---|---|
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# 11.6 Multiple Rapid Spanning Tree Protocol Status

Click **Advanced Application**, **Spanning Tree Protocol** in the navigation panel to display the status screen as shown next. See Section 11.1 on page 107 for more information on MRSTP.

**Note:** This screen is only available after you activate MRSTP on the switch.

**Figure 50** MRSTP: Status




The following table describes the labels in this screen.

**Table 28** Spanning Tree Protocol: Status

| LABEL | DESCRIPTION |
|---|---|
| Configuration | Click **Configuration** to configure MRSTP settings. Refer to Section 11.3 on page 110. |
| Tree | Select which STP tree configuration you want to view. |
| Bridge | **Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this switch. This switch may also be the root bridge. |
| Bridge ID | This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the switch is the root switch. |
| Hello Time (second) | This is the time interval (in seconds) at which the root switch transmits a configuration message. The root bridge determines **Hello Time**, **Max Age** and **Forwarding Delay** |

**Table 28** Spanning Tree Protocol: Status (continued)

| LABEL | DESCRIPTION |
|---|---|
| Max Age (second) | This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure. |
| Forwarding Delay (second) | This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding). |
| Cost to Bridge | This is the path cost from the root port on this switch to the root switch. |
| Port ID | This is the priority and number of the port on the switch through which this switch must communicate with the root of the Spanning Tree. |
| Topology Changed Times | This is the number of times the spanning tree has been reconfigured. |
| Time Since Last Change | This is the time since the spanning tree was last reconfigured. |

# CHAPTER 12
# Bandwidth Control

This chapter shows you how you can cap the maximum bandwidth using the **Bandwidth Control** screen.

## 12.1 Bandwidth Control Overview

Bandwidth control means defining a maximum allowable bandwidth for incoming and/or outgoing traffic flows on a port.

### 12.1.1 CIR and PIR

The Committed Information Rate (CIR) is the guaranteed bandwidth for the incoming traffic flow on a port. The Peak Information Rate (PIR) is the maximum bandwidth allowed for the incoming traffic flow on a port when there is no network congestion.

The CIR and PIR should be set for all ports that use the same uplink bandwidth. If the CIR is reached, packets are sent at the rate up to the PIR. When network congestion occurs, packets through the ingress port exceeding the CIR will be marked for drop.

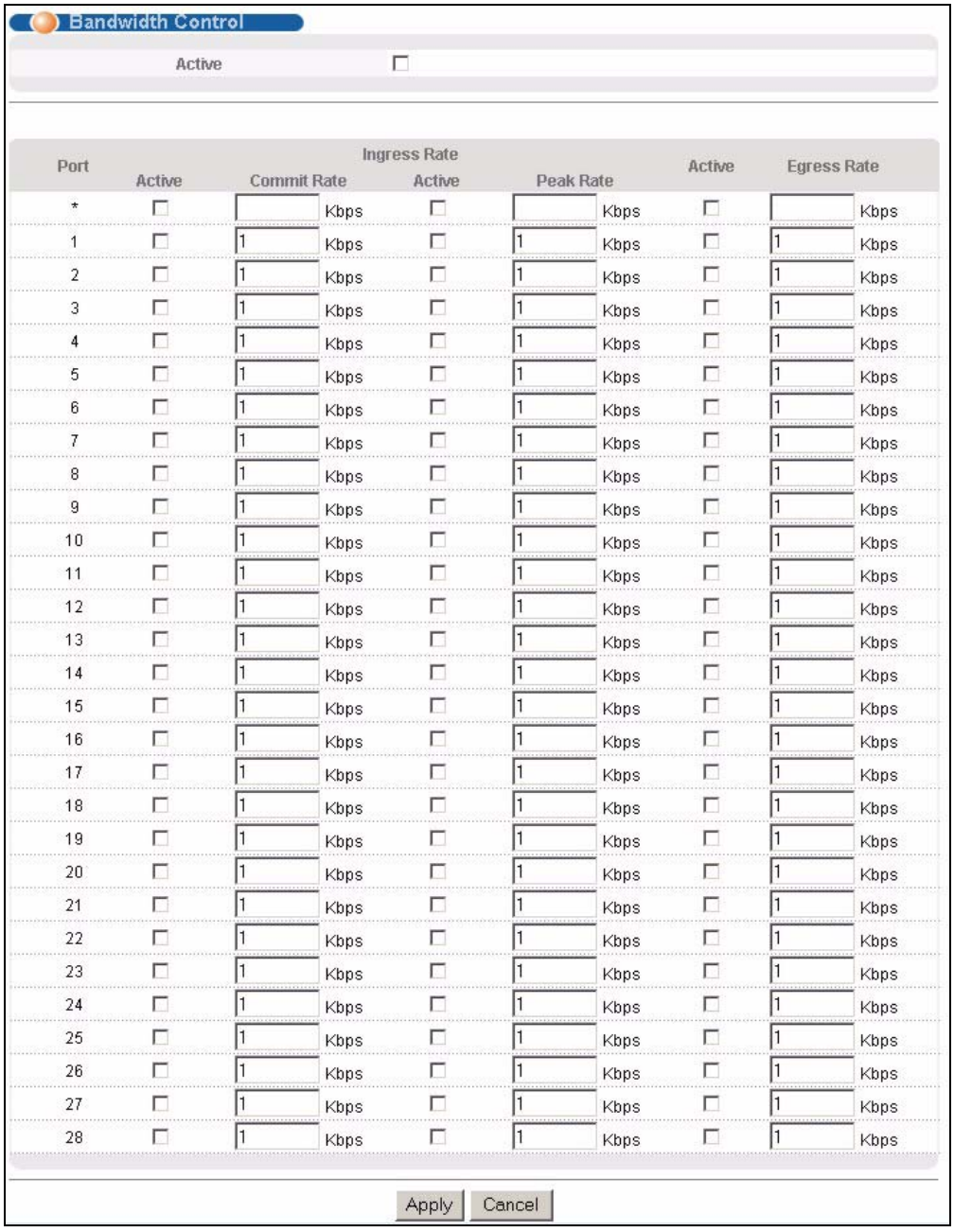
**Note:** The CIR should be less than the PIR.

The sum of CIRs cannot be greater than or equal to the uplink bandwidth.

## 12.2 Bandwidth Control Setup

Click **Advanced Application** and then **Bandwidth Control** in the navigation panel to bring up the screen as shown next.

**Figure 51** Bandwidth Control




The following table describes the related labels in this screen.

**Table 29** Bandwidth Control

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to enable bandwidth control on the switch. |
| Port | This field displays the port number. |

**Table 29** Bandwidth Control (continued)

| LABEL | DESCRIPTION |
|---|---|
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Ingress Rate | |
| Active | Select this check box to activate commit rate limits on this port. |
| Commit Rate | Specify the guaranteed bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port. The commit rate should be less than the peak rate. The sum of commit rates cannot be greater than or equal to the uplink bandwidth. |
| Active | Select this check box to activate peak rate limits on this port. |
| Peak Rate | Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port. |
| Active | Select this check box to activate egress rate limits on this port. |
| Egress Rate | Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the out-going traffic flow on a port. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 13
# Broadcast Storm Control

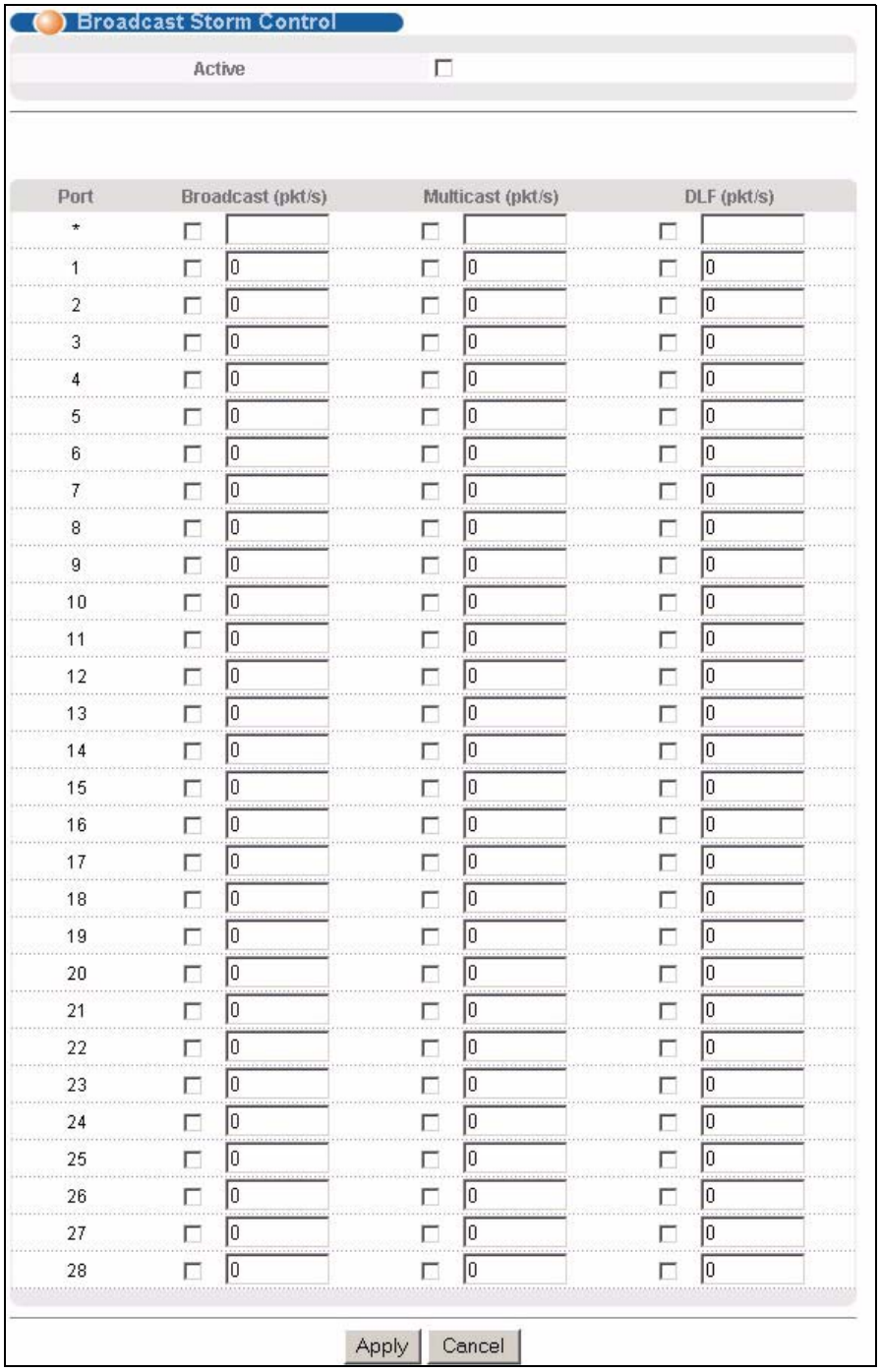
This chapter introduces and shows you how to configure the broadcast storm control feature.

## 13.1 Broadcast Storm Control Setup

Broadcast storm control limits the number of broadcast, multicast and destination lookup failure (DLF) packets the switch receives per second on the ports. When the maximum number of allowable broadcast, multicast and/or DLF packets is reached per second, the subsequent packets are discarded. Enable this feature to reduce broadcast, multicast and/or DLF packets in your network. You can specify limits for each packet type on each port.

Click **Advanced Application**, **Broadcast Storm Control** in the navigation panel to display the screen as shown next.

**Figure 52** Broadcast Storm Control



The following table describes the labels in this screen.

**Table 30** Broadcast Storm Control

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to enable traffic storm control on the switch. Clear this check box to disable this feature. |
| Port | This field displays a port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Broadcast (pkt/s) | Select this option and specify how many broadcast packets the port receives per second. |
| Multicast (pkt/s) | Select this option and specify how many multicast packets the port receives per second. |
| DLF (pkt/s) | Select this option and specify how many destination lookup failure (DLF) packets the port receives per second. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 14
# Mirroring

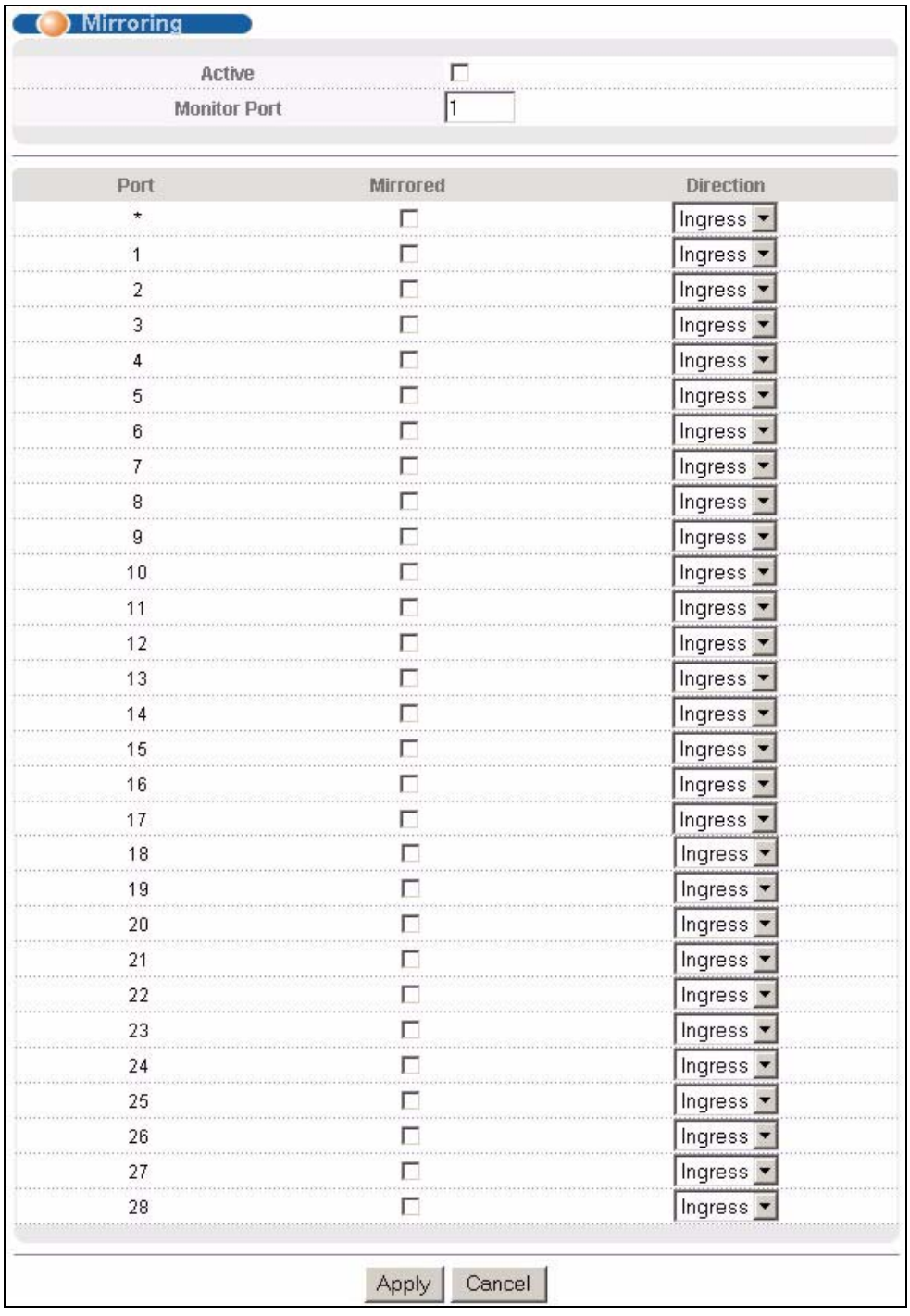
This chapter discusses the Mirror setup screens.

## 14.1 Port Mirroring Setup

Port mirroring allows you to copy a traffic flow to a monitor port (the port you copy the traffic to) in order that you can examine the traffic from the monitor port without interference.

Click **Advanced Application**, **Mirroring** in the navigation panel to display the **Mirroring** screen. Use this screen to select a monitor port and specify the traffic flow to be copied to the monitor port.

**Figure 53** Mirroring



The following table describes the labels in this screen.

**Table 31** Mirroring

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to activate port mirroring on the switch. Clear this check box to disable the feature. |
| Monitor Port | The monitor port is the port you copy the traffic to in order to examine it in more detail without interfering with the traffic flow on the original port(s). Enter the port number of the monitor port. |
| Port | This field displays the port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Mirrored | Select this option to mirror the traffic on a port. |
| Direction | Specify the direction of the traffic to mirror by selecting from the drop-down list box. Choices are **Egress** (outgoing), **Ingress** (incoming) and **Both**. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 15
# Link Aggregation

This chapter shows you how to logically aggregate physical links to form one logical, higher-bandwidth link.

## 15.1 Link Aggregation Overview

Link aggregation (trunking) is the grouping of physical ports into one logical higher-capacity link. You may want to trunk ports if for example, it is cheaper to use multiple lower-speed links than to under-utilize a high-speed, but more costly, single-port link.

However, the more ports you aggregate then the fewer available ports you have. A trunk group is one logical link containing multiple ports.

The beginning port of each trunk group must be physically connected to form a trunk group.

## 15.2 Dynamic Link Aggregation

The switch adheres to the IEEE 802.3ad standard for static and dynamic (LACP) port trunking.

The switch supports the link aggregation IEEE802.3ad standard. This standard describes the Link Aggregate Control Protocol (LACP), which is a protocol that dynamically creates and manages trunk groups.

When you enable LACP link aggregation on a port, the port can automatically negotiate with the ports at the remote end of a link to establish trunk groups. LACP also allows port redundancy, that is, if an operational port fails, then one of the "standby" ports become operational without user intervention. Please note that:

- You must connect all ports point-to-point to the same Ethernet switch and configure the ports for LACP trunking.
- LACP only works on full-duplex links.
- All ports in the same trunk group must have the same media type, speed, duplex mode and flow control settings.

Configure trunk groups or LACP before you connect the Ethernet switch to avoid causing network topology loops.

### 15.2.1 Link Aggregation ID

LACP aggregation ID consists of the following information[1]:

**Table 32** Link Aggregation ID: Local Switch

| SYSTEM PRIORITY | MAC ADDRESS | KEY | PORT PRIORITY | PORT NUMBER |
|---|---|---|---|---|
| 0000 | 00-00-00-00-00 | 0000 | 00 | 0000 |

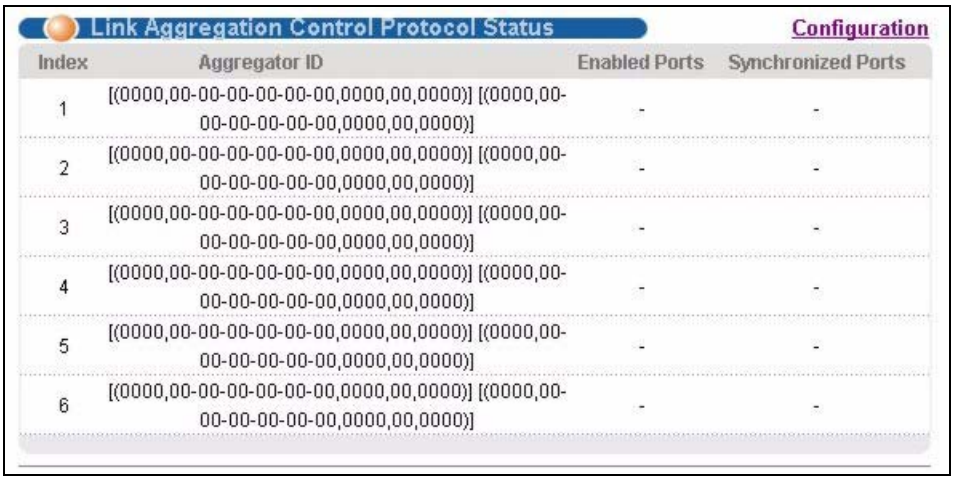
**Table 33** Link Aggregation ID: Peer Switch

| SYSTEM PRIORITY | MAC ADDRESS | KEY | PORT PRIORITY | PORT NUMBER |
|---|---|---|---|---|
| 0000 | 00-00-00-00-00 | 0000 | 00 | 0000 |

## 15.3 Link Aggregation Control Protocol Status

Click **Advanced Application**, **Link Aggregation** in the navigation panel. The **Link Aggregation Control Protocol Status screen** displays by default. See Section 15.1 on page 131 for more information.

**Figure 54** Link Aggregation Control Protocol Status




1. Port Priority and Port Number are 0 as it is the aggregator ID for the trunk group, not the individual port.

The following table describes the labels in this screen.

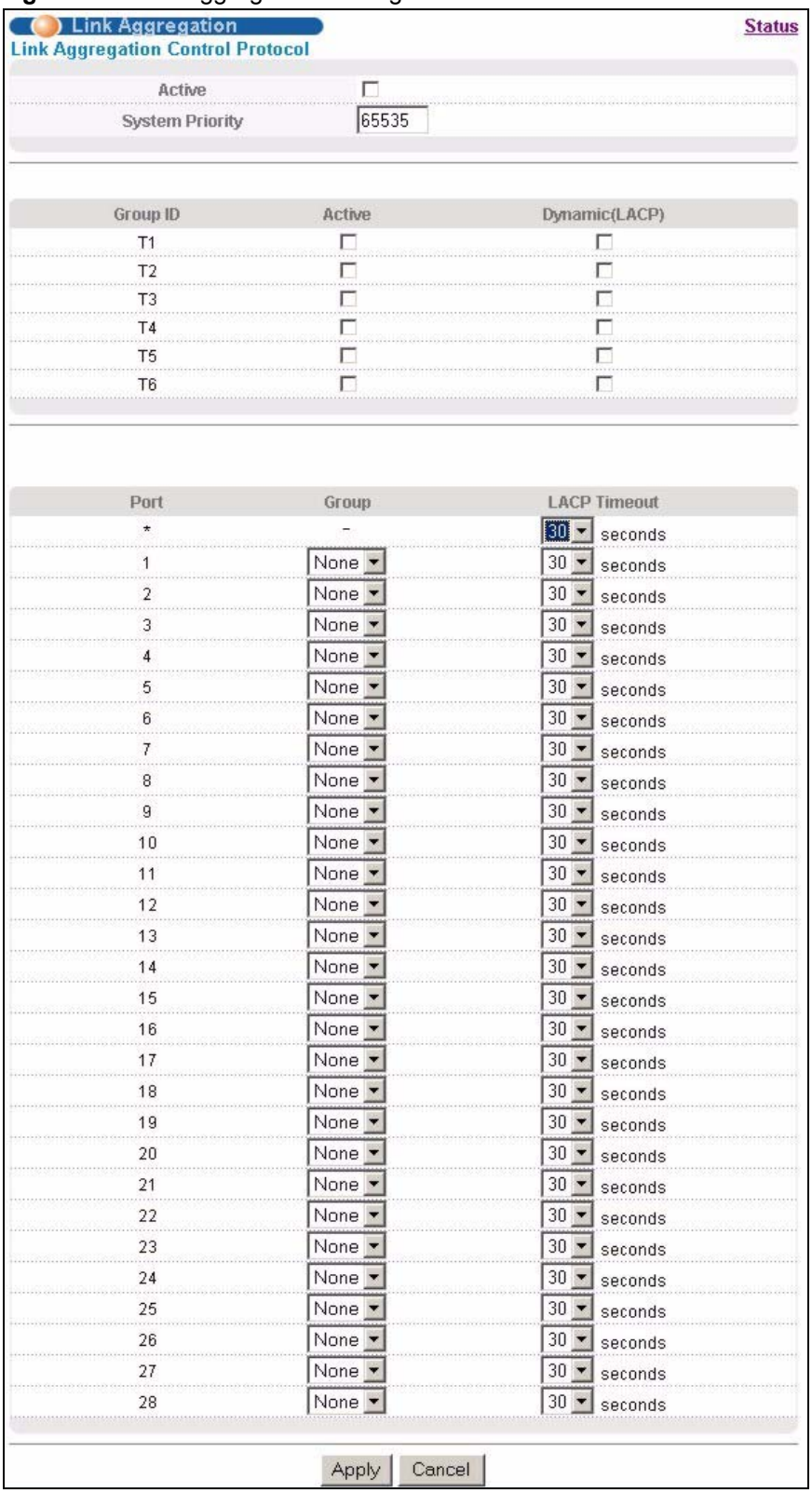
**Table 34** Link Aggregation Control Protocol Status

| LABEL | DESCRIPTION |
|---|---|
| Index | This field displays the trunk ID to identify a trunk group, that is, one logical link containing multiple ports. |
| Aggregator ID | Link Aggregator ID consists of the following: system priority, MAC address, key, port priority and port number. Refer to Section 15.2.1 on page 132 for more information on this field. |
| Enabled Port | These are the ports you have configured in the **Link Aggregation** screen to be in the trunk group. |
| Synchronized Ports | These are the ports that are currently transmitting data as one logical link in this trunk group. |

## 15.4 Link Aggregation Setup

Click **Configuration** in the **Link Aggregation Control Protocol Status** screen to display the screen shown next. See Section 15.1 on page 131 for more information on link aggregation.

**Figure 55** Link Aggregation: Configuration



The following table describes the labels in this screen.

**Table 35** Link Aggregation Control Protocol: Configuration

| LABEL | DESCRIPTION |
|---|---|
| Link Aggregation Control Protocol | |
| Active | Select this checkbox to enable Link Aggregation Control Protocol (LACP). |
| System Priority | LACP system priority is a number between 1 and 65,535. The switch with the lowest system priority (and lowest port number if system priority is the same) becomes the LACP "server". The LACP "server" controls the operation of LACP setup. Enter a number to set the priority of an active port using Link Aggregate Control Protocol (LACP). The smaller the number, the higher the priority level. |
| Group ID | The field identifies the link aggregation group, that is, one logical link containing multiple ports. |
| Active | Select this option to activate a trunk group. |
| Dynamic (LACP) | Select this check box to enable LACP for a trunk. |
| Port | This field displays the port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Group | Select the trunk group to which a port belongs. |
| LACP Timeout | Timeout is the time interval between the individual port exchanges of LACP packets in order to check that the peer port in the trunk group is still up. If a port does not respond after three tries, then it is deemed to be "down" and is removed from the trunk. Set a short timeout (one second) for busy trunked links to ensure that disabled ports are removed from the trunk group as soon as possible.<br>Select either 1 second or 30 seconds. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 16
# Port Authentication

This chapter describes the 802.1x authentication method and RADIUS server connection setup. See Section 36.9 on page 285 for information on how to use the commands to configure additional Radius server settings as well as multiple Radius server configuration.

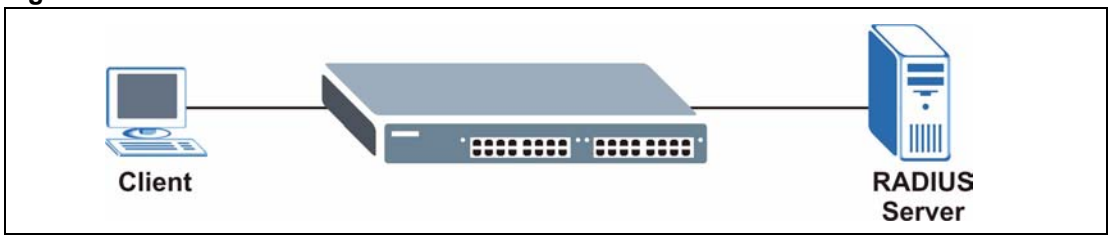
## 16.1 Port Authentication Overview

IEEE 802.1x is an extended authentication protocol[2] that allows support of RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.

### 16.1.1 RADIUS

RADIUS (Remote Authentication Dial-In User Service) authentication is a popular protocol used to authenticate users by means of an external server instead of (or in addition to) an internal device user database that is limited to the memory capacity of the device. In essence, RADIUS authentication allows you to validate an unlimited number of users from a central location.

**Figure 56** RADIUS Server




#### 16.1.1.1 Vendor Specific Attribute

A Vendor Specific Attribute (VSA) is an attribute-value pair that is sent between a RADIUS server and the ES-3124. Configure VSAs on the RADIUS server to set the ES-3124 to perform the following actions on an authenticated user:

- Limit bandwidth on incoming or outgoing traffic
- Assign account prilivege levels

2. At the time of writing, only Windows XP of the Microsoft operating systems supports it. See the Microsoft web site for information on other Windows operating system support. For other operating systems, see its documentation. If your operating system does not support 802.1x, then you may need to install 802.1x client software.

**Note:** Refer to the documentation that comes with your RADIUS server on how to configure a VSA.

The following table describes the VSAs supported on the switch.

**Table 36** Supported VSA

| FUNCTION | ATTRIBUTE |
|---|---|
| Ingress Bandwidth Assignment | `Vendor-Id = 890` (ZyXEL)<br>`Vendor-Type = 1`<br>`Vendor-data =` ingress rate (decimal) |
| Egress Bandwidth Assignment | `Vendor-Id = 890` (ZyXEL)<br>`Vendor-Type = 2`<br>`Vendor-data =` egress rate (decimal) |
| Privilege Assignment | `Vendor-ID = 890` (ZyXEL)<br>`Vendor-Type = 3`<br>`Vendor-Data = "shell:priv-lvl=N"`<br>or<br>`Vendor-ID = 9` (CISCO)<br>`Vendor-Type = 1` (CISCO-AVPAIR)<br>`Vendor-Data = "shell:priv-lvl=N"`<br>where `N` is a privilege level (from 0 to 14).<br>**Note:** If you set the privilege level of a login account differently on the RADIUS server(s) and the switch, the user is assigned a privilege level from the database (RADIUS or local) the switch uses first for user authentication. |

### 16.1.1.2 Tunnel Protocol Attribute

You can configure tunnel protocol attributes on the RADIUS server to assign a port on the switch to a VLAN (fixed, untagged). This will also set the port's VID. Refer to RFC 3580 for more information.

**Table 37** Supported Tunnel Protocol Attribute

| FUNCTION | ATTRIBUTE |
|---|---|
| VLAN Assignment | `Tunnel-Type = VLAN(13)`<br>`Tunnel-Medium-Type = 802(6)`<br>`Tunnel-Private-Group-ID =` VLAN ID<br>**Note:** You must also create a VLAN with the specified VID on the switch. |

## 16.2 Port Authentication Configuration

To enable port authentication, first activate IEEE802.1x security (both on the switch and the port(s)) then configure the RADIUS server settings.

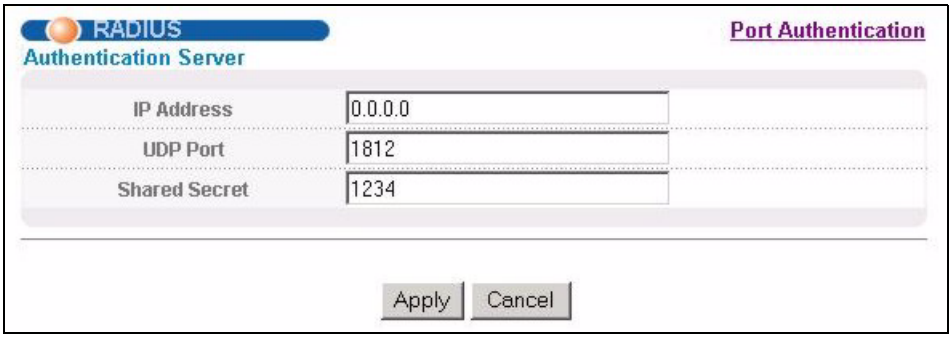
Click **Advanced Application**, **Port Authentication** in the navigation panel to display the screen as shown.

**Figure 57** Port Authentication

## 16.2.1 Configuring RADIUS Server Settings

Use this screen to configure your RADIUS server settings. See Section 16.1.1 on page 137 for more information on RADIUS servers. From the **Port Authentication** screen, click **RADIUS** to display the configuration screen as shown.

**Figure 58** Port Authentication: RADIUS




The following table describes the labels in this screen.

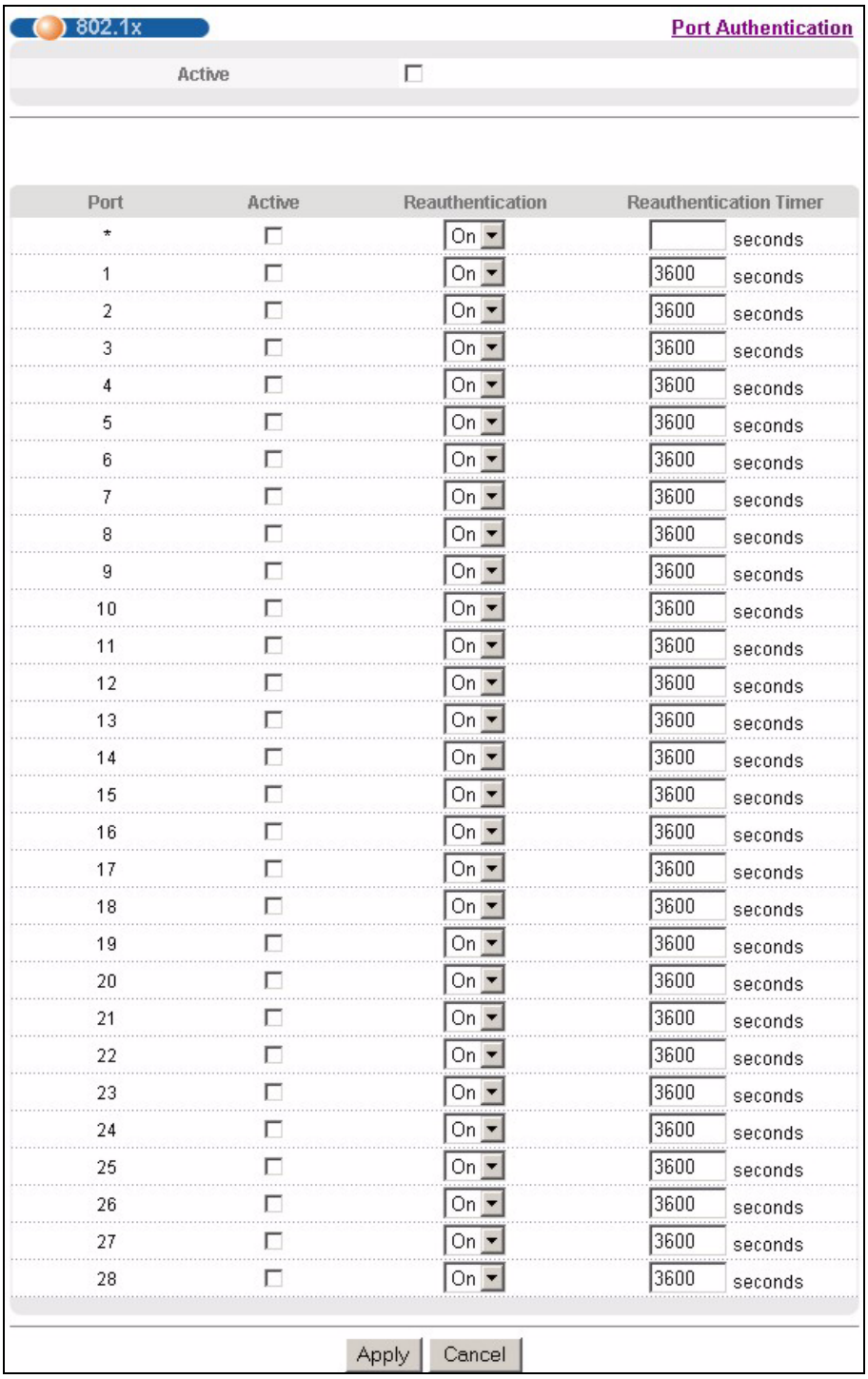
**Table 38** Port Authentication: RADIUS

| LABEL | DESCRIPTION |
|---|---|
| Authentication Server | |
| IP Address | Enter the IP address of the external RADIUS server in dotted decimal notation. |
| UDP Port | The default port of the RADIUS server for authentication is **1812**. You need not change this value unless your network administrator instructs you to do so. |
| Shared Secret | Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external RADIUS server and the switch. This key is not sent over the network. This key must be the same on the external RADIUS server and the switch. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

### 16.2.2 Activate IEEE 802.1x Security

Use this screen to activate IEEE 802.1x security. From the **Port Authentication** screen, display the configuration screen as shown.

**Figure 59** Port Authentication: 802.1x



The following table describes the labels in this screen.

**Table 39** Port Authentication: 802.1x

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to permit 802.1x authentication on the switch.<br><br>**Note:** You must first enable 802.1x authentication on the switch before configuring it on each port. |
| Port | This field displays a port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br><br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Active | Select this checkbox to permit 802.1x authentication on this port. You must first allow 802.1x authentication on the switch before configuring it on each port. |
| Reauthentication | Specify if a subscriber has to periodically re-enter his or her username and password to stay connected to the port. |
| Reauthentication Timer | Specify how often a client has to re-enter his or her username and password to stay connected to the port. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 17
# Port Security

This chapter shows you how to set up port security.

## 17.1 About Port Security

Port security allows only packets with dynamically learned MAC addresses and/or configured static MAC addresses to pass through a port on the switch. The switch can learn up to 16K MAC addresses in total with no limit on individual ports other than the sum cannot exceed 16K.

For maximum port security, enable this feature, disable MAC address learning and configure static MAC address(es) for a port. It is not recommended you disable port security together with MAC address learning as this will result in many broadcasts. By default, MAC address learning is still enabled even though the port security is not activated.

## 17.2 Port Security Setup

Click **Advanced Application**, **Port Security** in the navigation panel to display the screen as shown.

**Figure 60** Port Security

The following table describes the labels in this screen.

**Table 40** Port Security

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this option to enable port security on the switch. |
| Port | This field displays a port number. |

**Table 40** Port Security (continued)

| LABEL | DESCRIPTION |
|---|---|
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Active | Select this check box to enable the port security feature on this port. The switch forwards packets whose MAC address(es) is in the MAC address table on this port. Packets with no matching MAC address(es) are dropped.<br>Clear this check box to disable the port security feature. The switch forwards all packets on this port. |
| Address Learning | MAC address learning reduces outgoing broadcast traffic. For MAC address learning to occur on a port, the port itself must be active with address learning enabled. |
| Limited Number of Learned MAC Address | Use this field to limit the number of (dynamic) MAC addresses that may be learned on a port. For example, if you set this field to "5" on port 2, then only the devices with these five learned MAC addresses may access port 2 at any one time. A sixth device would have to wait until one of the five learned MAC addresses aged out. MAC address aging out time can be set in the **Switch Setup** screen. The valid range is from "0" to "254". "0" means this feature is disabled. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 18
# Classifier

This chapter introduces and shows you how to configure the packet classifier on the switch.

## 18.1 About the Classifier and QoS

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to control the use of bandwidth. Without QoS, all traffic data is equally likely to be dropped when the network is congested. This can cause a reduction in network performance and make the network inadequate for time-critical application such as video-on-demand.

A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming port number. For example, you can configure a classifier to select traffic from the same protocol port (such as Telnet) to form a flow.

Configure QoS on the switch to group and prioritize application traffic and fine-tune network performance. Setting up QoS involves two separate steps:

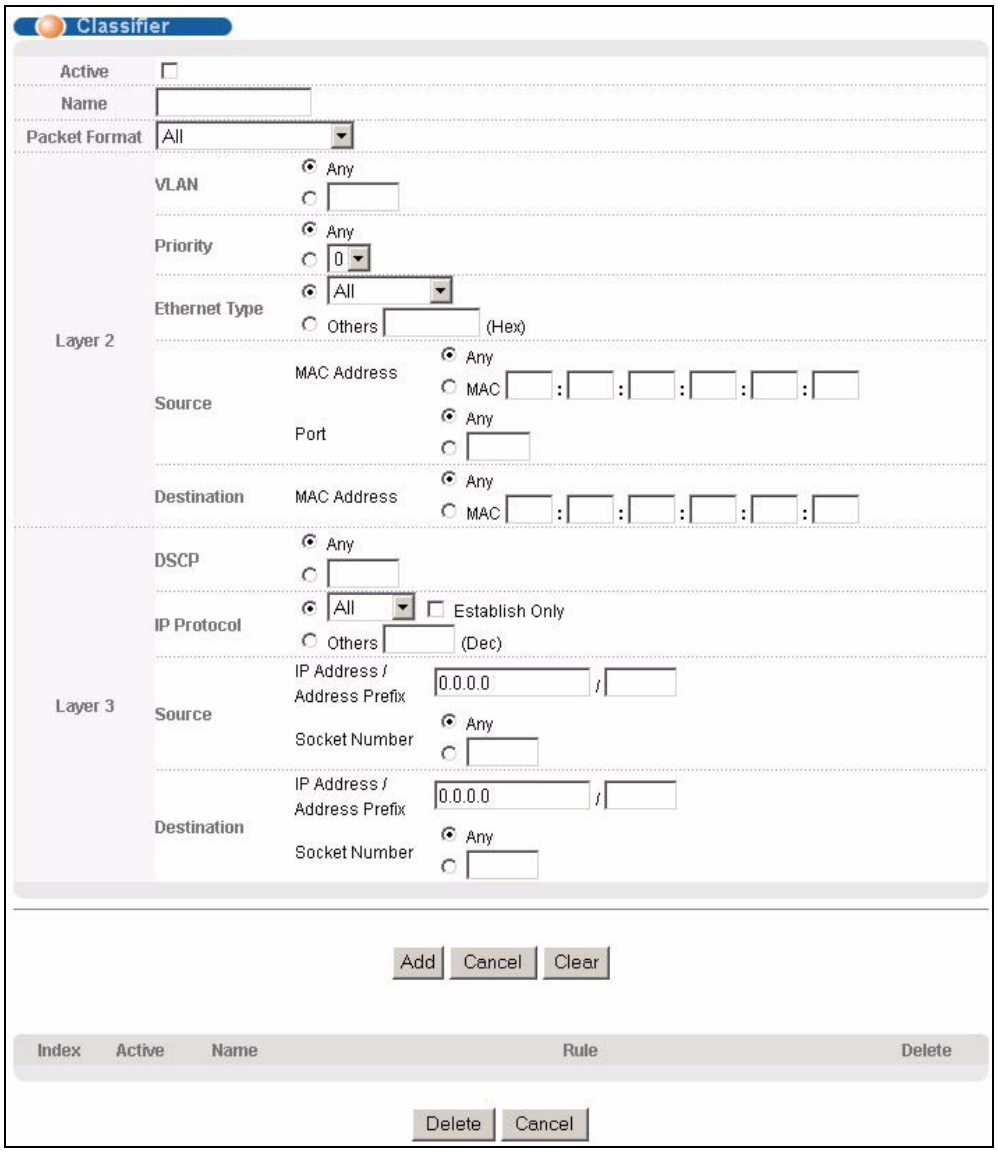
1. Configure classifiers to sort traffic into different flows.
2. Configure policy rules to define actions to be performed for a classified traffic flow (refer to Chapter 19 on page 153 to configure policy rules).

## 18.2 Configuring the Classifier

Use the **Classifier** screen to define the classifiers. After you define the classifier, you can specify actions (or policy) to act upon the traffic that matches the rules. To configure policy rules, refer to Chapter 19 on page 153.

Click **Advanced Application** and **Classifier** in the navigation panel to display the configuration screen as shown.

**Figure 61** Classifier




The following table describes the labels in this screen.

**Table 41** Classifier

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this option to enable this rule. |
| Name | Enter a descriptive name for this rule for identifying purposes. |
| Packet Format | Specify the format of the packet. Choices are **All**, **802.3 tagged**, **802.3 untagged**, **Ethernet II tagged** and **Ethernet II untagged**.<br>A value of **802.3** indicates that the packets are formatted according to the IEEE 802.3 standards.<br>A value of **Ethernet II** indicates that the packets are formatted according to RFC 894, Ethernet II encapsulation. |

**Table 41** Classifier (continued)

| LABEL | DESCRIPTION |
|---|---|
| Layer 2<br>Specify the fields below to configure a layer 2 classifier. | |
| VLAN | Select **Any** to classify traffic from any VLAN or select the second option and specify the source VLAN ID in the field provided. |
| Priority | Select **Any** to classify traffic from any priority level or select the second option and specify a priority level in the field provided. |
| Ethernet Type | Select an Ethernet type or select **Other** and enter the Ethernet type number in hexadecimal value. Refer to Table 43 on page 150 for information. |
| Source | |
| MAC Address | Select **Any** to apply the rule to all MAC addresses.<br>To specify a source, select the second choice and type a MAC address in valid MAC address format (six hexadecimal character pairs). |
| Port | Type the port number to which the rule should be applied. You may choose one port only or all ports (**Any**). |
| Destination | |
| MAC Address | Select **Any** to apply the rule to all MAC addresses.<br>To specify a destination, select the second choice and type a MAC address in valid MAC address format (six hexadecimal character pairs). |
| Layer 3<br>Specify the fields below to configure a layer 3 classifier. | |
| DSCP | Select **Any** to classify traffic from any DSCP or select the second option and specify a DSCP (DiffServ Code Point) number between 0 and 63 in the field provided. |
| IP Protocol | Select an IP protocol type or select **Other** and enter the protocol number in decimal value. Refer to Table 44 on page 151 for more information.<br>You may select **Establish Only** for **TCP** protocol type. This means that the switch will pick out the packets that are sent to establish TCP connections. |
| Source | |
| IP Address/ Address Prefix | Enter a source IP address in dotted decimal notation.<br>Specify the address prefix by entering the number of ones in the subnet mask. |
| Socket Number | **Note:** You must select either **UDP** or **TCP** in the **IP Protocol** field before you configure the socket numbers.<br>Select **Any** to apply the rule to all TCP/UDP protocol port numbers or select the second option and enter a TCP/UDP protocol port number. |
| Destination | |
| IP Address/ Address Prefix | Enter a destination IP address in dotted decimal notation.<br>Specify the address prefix by entering the number of ones in the subnet mask. |
| Socket Number | **Note:** You must select either **UDP** or **TCP** in the **IP Protocol** field before you configure the socket numbers.<br>Select **Any** to apply the rule to all TCP/UDP protocol port numbers or select the second option and enter a TCP/UDP protocol port number. |

**Table 41** Classifier (continued)

| LABEL | DESCRIPTION |
|---|---|
| Add | Click **Add** to insert the entry in the summary table below. |
| Cancel | Click **Cancel** to reset the fields back to your previous configuration. |
| Clear | Click **Clear** to set the above fields back to the factory defaults. |

## 18.3 Viewing and Editing Classifier Configuration

To view a summary of the classifier configuration, scroll down to the summary table at the bottom of the **Classifier** screen. To change the settings of a rule, click a number in the **Index** field.

**Note:** When two rules conflict with each other, a higher layer rule has priority over lower layer rule.

**Figure 62** Classifier: Summary Table

The following table describes the labels in this screen.

**Table 42** Classifier: Summary Table

| LABEL | DESCRIPTION |
|---|---|
| Index | This field displays the index number of the rule. Click an index number to edit the rule. |
| Active | This field displays **Yes** when the rule is activated and **No** when it is deactivated. |
| Name | This field displays the descriptive name for this rule. This is for identification purpose only. |
| Rule | This field displays a summary of the classifier rule's settings. |
| Delete | Click **Delete** to remove the selected entry from the summary table. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

The following table shows some other common Ethernet types and the corresponding protocol number.

**Table 43** Common Ethernet Types and Protocol Number

| ETHERNET TYPE | PROTOCOL NUMBER |
|---|---|
| IP ETHII | 0800 |
| X.75 Internet | 0801 |
| NBS Internet | 0802 |

**Table 43** Common Ethernet Types and Protocol Number

| ETHERNET TYPE | PROTOCOL NUMBER |
|---|---|
| ECMA Internet | 0803 |
| Chaosnet | 0804 |
| X.25 Level 3 | 0805 |
| XNS Compat | 0807 |
| Banyan Systems | 0BAD |
| BBN Simnet | 5208 |
| IBM SNA | 80D5 |
| AppleTalk AARP | 80F3 |

Some of the most common IP ports are:

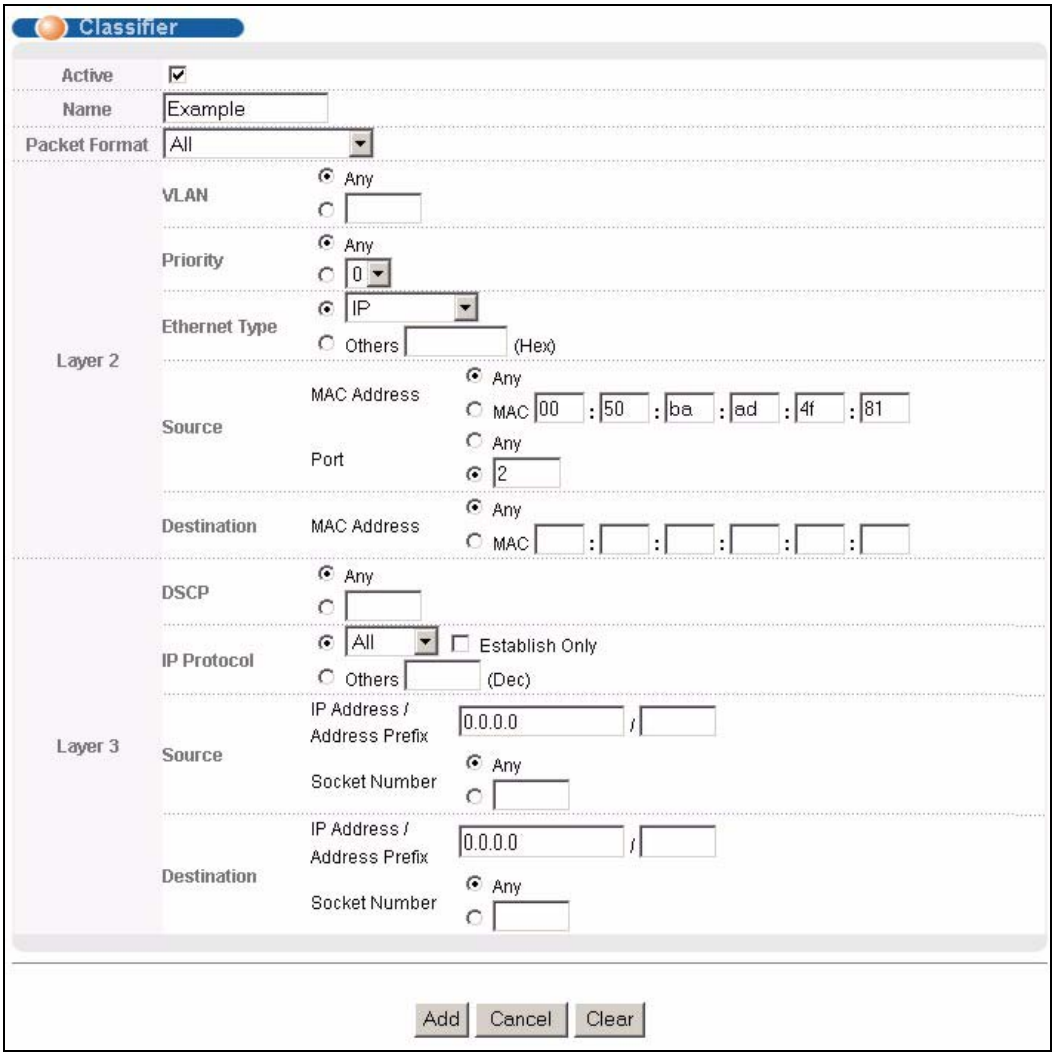
**Table 44** Common IP Ports

| PORT NUMBER | PORT NAME |
|---|---|
| 21 | FTP |
| 23 | Telnet |
| 25 | SMTP |
| 53 | DNS |
| 80 | HTTP |
| 110 | POP3 |

## 18.4 Classifier Example

The following figure shows an example where you configure a classifier that identifies all traffic from MAC address 00:50:ba:ad:4f:81 on port 2.

**Figure 63** Classifier: Example



# CHAPTER 19
# Policy Rule

This chapter shows you how to configure policy rules.

## 19.1 Policy Rules Overview

A classifier distinguishes traffic into flows based on the configured criteria (refer to Chapter 18 on page 147 for more information). A policy rule ensures that a traffic flow gets the requested treatment in the network.

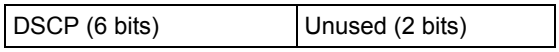
### 19.1.1 DiffServ

DiffServ (Differentiated Services) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

### 19.1.2 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.



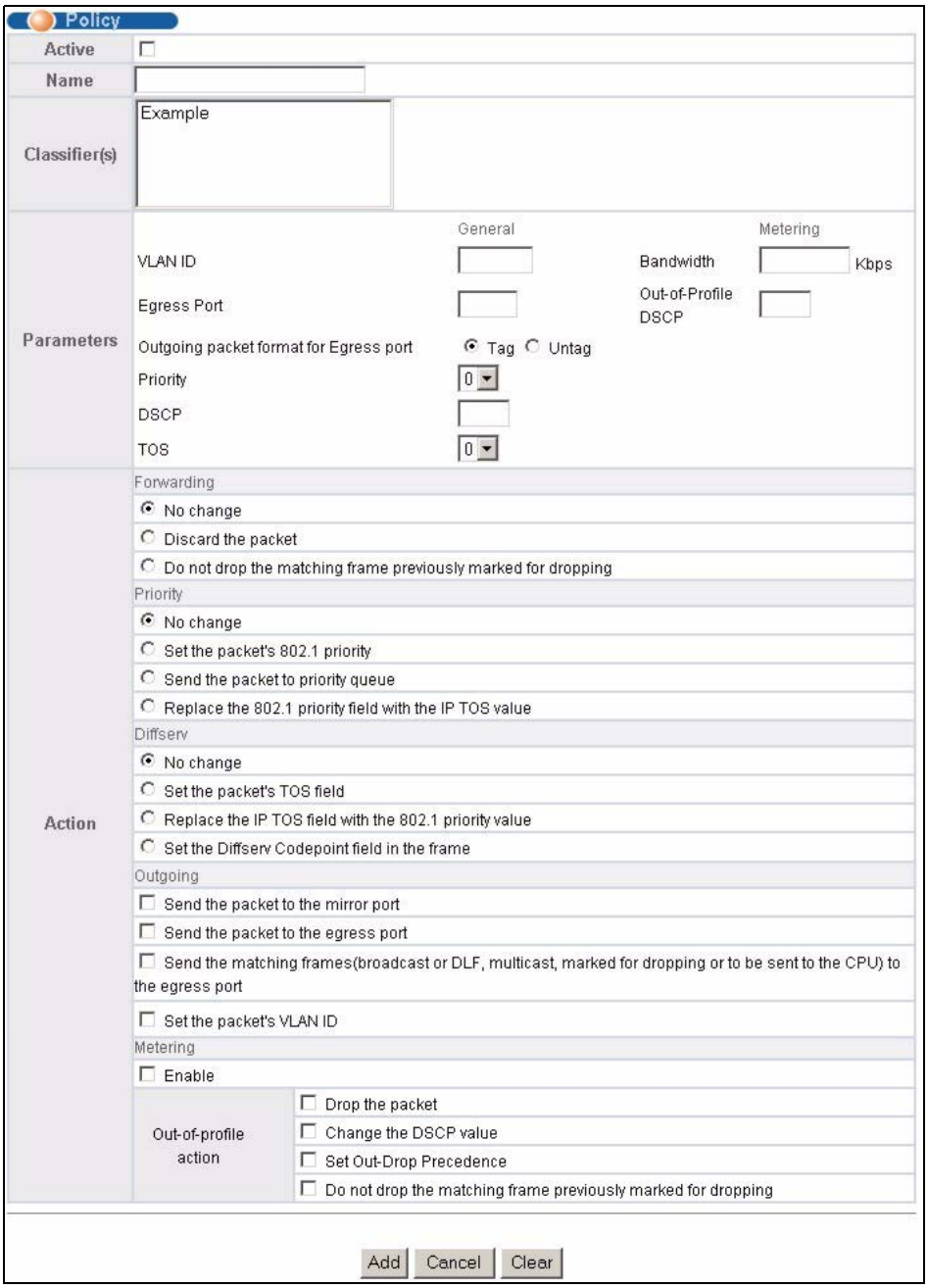

The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different kinds of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

# 19.2 Configuring Policy Rules

You must first configure a classifier in the **Classifier** screen. Refer to Section 18.2 on page 147 for more information.

Click **Advanced Applications** and then **Policy Rule** in the navigation panel to display the screen as shown.

**Figure 64** Policy



The following table describes the labels in this screen.

**Table 45** Policy

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this option to enable the policy. |
| Name | Enter a descriptive name for identification purposes. |
| Classifier(s) | This field displays the active classifier(s) you configure in the **Classifier** screen.<br>Select the classifier(s) to which this policy rule applies. To select more than one classifier, press [SHIFT] and select the choices at the same time. |
| Parameters<br>Set the fields below for this policy. You only have to set the field(s) that is related to the action(s) you configure in the **Action** field. | |
| General | |
| VLAN ID | Specify a VLAN ID number. |
| Egress Port | Type the number of an outgoing port. |
| Outgoing packet format for Egress port | Select **Tag** to add the specified VID to packets on the specified outgoing port. Otherwise, select **Untag**. |
| Priority | Specify a priority level. |
| DSCP | Specify a DSCP (DiffServ Code Point) number between 0 and 63. |
| TOS | Specify the type of service (TOS) priority level. |
| Metering | You can configure the desired bandwidth available to a traffic flow. Traffic that exceeds the maximum bandwidth allocated (in cases where the network is congested) is called out-of-profile traffic. |
| Bandwidth | Specify the bandwidth in kilobit per second (Kbps). Enter a number between 1 and 1000000. |
| Out-of-Profile DSCP | Specify a new DSCP number (between 0 and 63) if you want to replace or remark the DSCP number for out-of-profile traffic. |
| Action<br>Specify the action(s) the switch takes on the associated classified traffic flow. | |
| Forwarding | Select **No change** to forward the packets.<br>Select **Discard the packet** to drop the packets.<br>Select **Do not drop the matching frame previously marked for dropping** to retain the frames that were marked to be dropped before. |
| Priority | Select **No change** to keep the priority setting of the frames.<br>Select **Set the packet's 802.1 priority** to replace the packet's 802.1 priority field with the value you set in the Priority field.<br>Select **Send the packet to priority queue** to put the packets in the designated queue.<br>Select **Replace the 802.1 priority field with the IP TOS value** to replace the packet's 802.1 priority field with the value you set in the **TOS** field. |

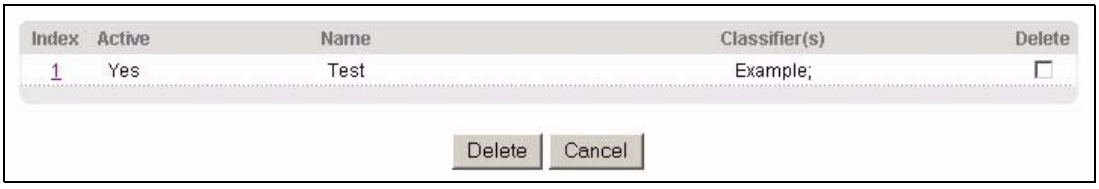
**Table 45** Policy (continued)

| LABEL | DESCRIPTION |
|---|---|
| Diffserv | Select **No change** to keep the TOS and/or DSCP fields in the packets.<br>Select **Set the packet's TOS field** to set the TOS field with the value you configure in the **TOS** field.<br>Select **Replace the IP TOS with the 802.1 priority value** to replace the TOS field with the value you configure in the **Priority** field.<br>Select **Set the Diffserv Codepoint field in the frame** to set the DSCP field with the value you configure in the **DSCP** field. |
| Outgoing | Select **Send the packet to the mirror port** to send the packet to the mirror port.<br>Select **Send the packet to the egress port** to send the packet to the egress port.<br>Select **Send the matching frames (broadcast or DLF, multicast, marked for dropping or to be sent to the CPU) to the egress port** to send the broadcast, multicast, DLF, marked-to-drop or CPU frames to the egress port.<br>Select **Set the packet's VLAN ID** to set the VLAN ID of the packet with the value you configure in the **VLAN ID** field. |
| Metering | Select **Enable** to activate bandwidth limitation on the traffic flow(s) then set the actions to be taken on out-of-profile packets. |
| Out-of-profile action | Select the action(s) to be performed for out-of-profile traffic.<br>Select **Drop the packet** to discard the out-of-profile traffic.<br>Select **Change the DSCP value** to replace the DSCP field with the value specified in the **Out of profile DSCP** field.<br>Select **Set Out-Drop Precedence** to mark out-of-profile traffic and drop it when network is congested.<br>Select **Do not drop the matching frame previously marked for dropping** to queue the frames that are marked to be dropped. |
| Add | Click **Add** to inset the entry to the summary table below. |
| Cancel | Click **Cancel** to reset the fields back to your previous configuration. |
| Clear | Click **Clear** to set the above fields back to the factory defaults. |

# 19.3 Viewing and Editing Policy Configuration

To view a summary of the classifier configuration, scroll down to the summary table at the bottom of the **Policy** screen. To change the settings of a rule, click a number in the **Index** field.

**Figure 65** Policy: Summary Table



The following table describes the labels in this screen.

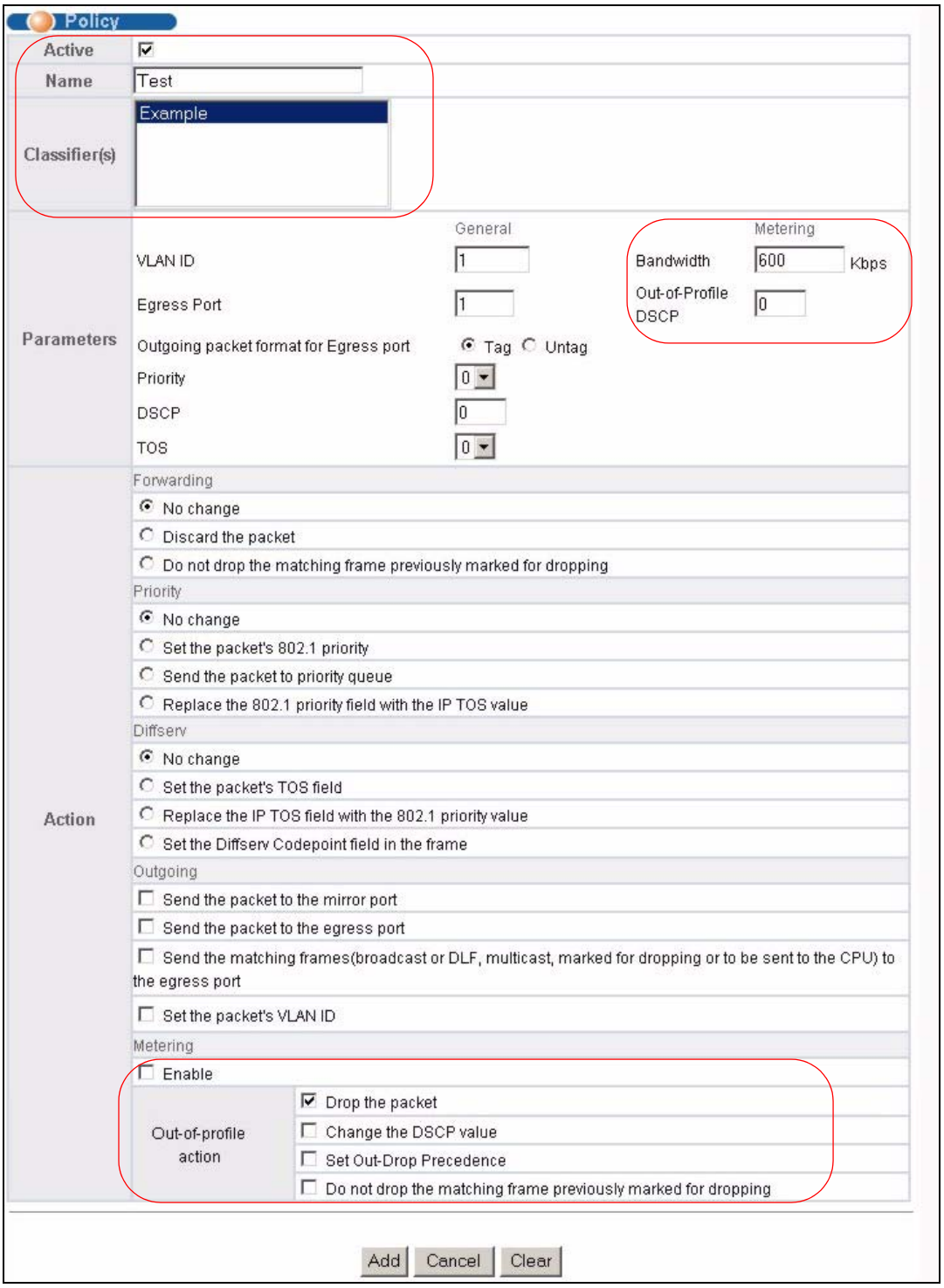
**Table 46** Policy: Summary Table

| LABEL | DESCRIPTION |
|---|---|
| Index | This field displays the policy index number. Click an index number to edit the policy. |
| Active | This field displays **Yes** when policy is activated and **No** when is it deactivated. |
| Name | This field displays the descriptive name for this policy. This is for identification purposes only. |
| Classifier(s) | This field displays the name(s) of the classifier to which this policy applies. |
| Delete | Click **Delete** to remove the selected entry from the summary table. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

## 19.4 Policy Example

The figure below shows an example **Policy** screen where you configure a policy to limit bandwidth and discard out-of-band traffic on a traffic flow classified using the **Example** classifier (refer to Section 18.4 on page 151).

**Figure 66** Policy Example



# CHAPTER 20
# Queuing Method

This chapter introduces the queuing methods supported.

## 20.1 Queuing Method Overview

Queuing is used to help solve performance degradation when there is network congestion. Use the **Queuing Method** screen to configure queuing algorithms for outgoing traffic. See also **Priority Queue Assignment** in **Switch Setup** and **802.1p Priority** in **Port Setup** for related information.

Queuing algorithms allow switches to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.

### 20.1.1 Strictly Priority

Strictly Priority (SP) services queues based on priority only. As traffic comes into the switch, traffic on the highest priority queue, Q7 is transmitted first. When that queue empties, traffic on the next highest-priority queue, Q6 is transmitted until Q6 empties, and then traffic is transmitted on Q5 and so on. If higher priority queues never empty, then traffic on lower priority queues never gets sent. SP does not automatically adapt to changing network requirements.

### 20.1.2 Weighted Fair Scheduling

Weighted Fair Scheduling is used to guarantee each queue's minimum bandwidth based on its bandwidth weight (portion) (the number you configure in the Weight field - see Figure 18 1) when there is traffic congestion. WFS is activated only when a port has more traffic than it can handle. Queues with larger weights get more guaranteed bandwidth than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues. By default, the weight for Q0 is 1, for Q1 is 2, for Q2 is 3, and so on. Guaranteed bandwidth is calculated as follows:

$$\frac{\text{Queue Weight}}{\text{Total Queue Weight}} \times \text{Port Speed}$$

For example, using the default setting, Q0 on Port 1 gets a guaranteed bandwidth of:

$$\frac{1}{1+2+3+4+5+6+7+8} \times 100\ \text{Mbps} = 3\ \text{Mbps}$$

### 20.1.3 Weighted Round Robin Scheduling (WRR)

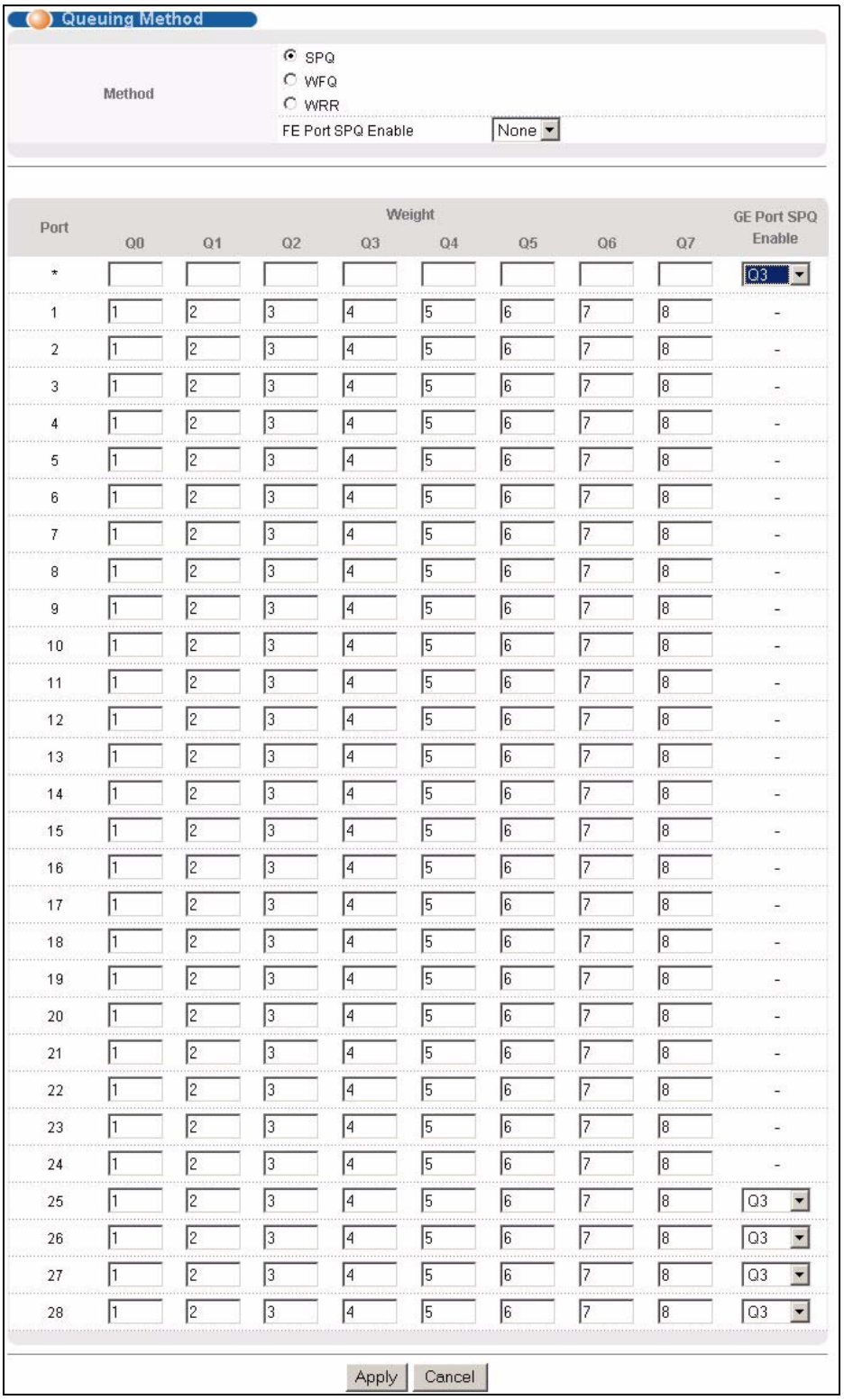
Round Robin Scheduling services queues on a rotating basis and is activated only when a port has more traffic than it can handle. A queue is a given an amount of bandwidth irrespective of the incoming traffic on that port. This queue then moves to the back of the list. The next queue is given an equal amount of bandwidth, and then moves to the end of the list; and so on, depending on the number of queues being used. This works in a looping fashion until a queue is empty.

Weighted Round Robin Scheduling (WRR) uses the same algorithm as round robin scheduling, but services queues based on their priority and queue weight (the number you configure in the queue **Weight** field) rather than a fixed amount of bandwidth. WRR is activated only when a port has more traffic than it can handle. Queues with larger weights get more service than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues and returns to queues that have not yet emptied.

## 20.2 Configuring Queuing

Click **Advanced Application**, **Queuing Method** in the navigation panel.

**Figure 67** Queuing Method



The following table describes the labels in this screen.

**Table 47** Queuing Method

| LABEL | DESCRIPTION |
|---|---|
| Method | Select **SPQ (**Strictly Priority Queuing), **WFQ** (Weighted Fair Scheduling) or **WRR** (Weighted Round Robin).<br>Strictly Priority services queues based on priority only. When the highest priority queue empties, traffic on the next highest-priority queue begins. Q7 has the highest priority and Q0 the lowest.<br>Weighted Fair Scheduling is used to guarantee each queue's minimum bandwidth based on their bandwidth portion (weight) (the number you configure in the **Weight** field). Queues with larger weights get more guaranteed bandwidth than queues with smaller weights.<br>Weighted Round Robin Scheduling services queues on a rotating basis based on their queue weight (the number you configure in the queue **Weight** field). Queues with larger weights get more service than queues with smaller weights. |
| FE Port SPQ Enable | This field is applicable only when you select **WFQ** or **WRR**.<br>Select a queue (**Q0** to **Q7**) to have the switch use **Strictly Priority** to service the subsequent queue(s) after and including the specified queue for the 10/100 Mbps Ethernet ports. For example, if you select **Q5**, the switch services traffic on **Q5**, **Q6** and **Q7** using **Strictly Priority**.<br>Select **None** to always use **WFQ** or **WRR** for the 10/100 Mbps Ethernet ports. |
| Port | This label shows the port you are configuring. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Weight | When you select **WFQ** or **WRR** enter the queue weight here. Bandwidth is divided across the different traffic queues according to their weights. |
| GE Port SPQ Enable | This field is applicable only when you select **WFQ** or **WRR**.<br>Select a queue (**Q0** to **Q7**) to have the switch use **Strictly Priority** to service the subsequent queue(s) after and including the specified queue for the gigabit ports. For example, if you select **Q5**, the switch services traffic on **Q5**, **Q6** and **Q7** using **Strictly Priority**.<br>Select **None** to always use **WFQ** or **WRR** for the gigabit ports. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 21
# VLAN Stacking

This chapter shows you how to configure VLAN stacking on your switch. See the chapter on VLANs for more background information on Virtual LAN

## 21.1 VLAN Stacking Overview

A service provider can use VLAN stacking to allow it to distinguish multiple customers VLANs, even those with the same (customer-assigned) VLAN ID, within its network.

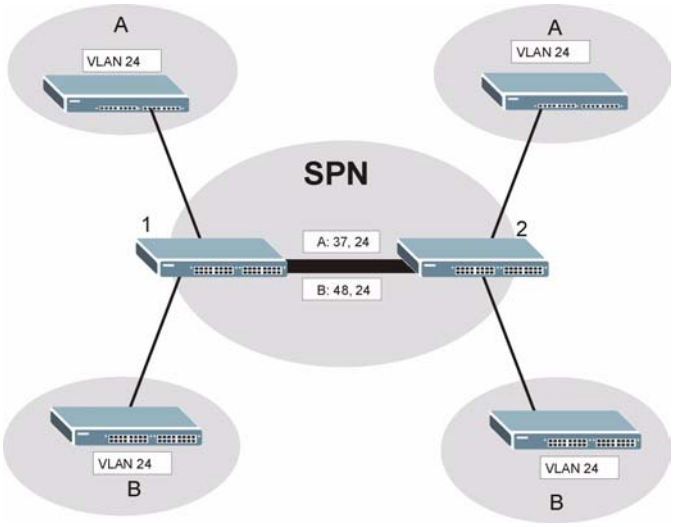
Use VLAN stacking to add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. By tagging the tagged frames ("double-tagged" frames), the service provider can manage up to 4,094 VLAN groups with each group containing up to 4,094 customer VLANs. This allows a service provider to provide different service, based on specific VLANs, for many different customers.

A service provider's customers may require a range of VLANs to handle multiple applications. A service provider's customers can assign their own inner VLAN tags on ports for these applications. The service provider can assign an outer VLAN tag for each customer. Therefore, there is no VLAN tag overlap among customers, so traffic from different customers is kept separate.

### 21.1.1 VLAN Stacking Example

In the following example figure, both **A** and **B** are Service Provider's Network (SPN) customers with VPN tunnels between their head offices and branch offices respectively. Both have an identical VLAN tag for their VLAN group. The service provider can separate these two VLANs within its network by adding tag 37 to distinguish customer **A** and tag 48 to distinguish customer **B** at edge device **1** and then stripping those tags at edge device **2** as the data frames leave the network.

**Figure 68** VLAN Stacking Example




## 21.2 VLAN Stacking Port Roles

Each port can have three VLAN stacking "roles", **Normal**, **Access Port** and **Tunnel** (the latter is for Gigabit ports only).

- Select **Normal** for "regular" (non-VLAN stacking) IEEE 802.1Q frame switching.
- Select **Access Port** for ingress ports on the service provider's edge devices (**1** and **2** in the VLAN stacking example figure). The incoming frame is treated as "untagged", so a second VLAN tag (outer VLAN tag) can be added.

**Note:** Static VLAN **Tx Tagging** MUST be disabled on a port where you choose **Normal** or **Access Port**.

- Select **Tunnel Port** (available for Gigabit ports only) for egress ports at the edge of the service provider's network. All VLANs belonging to a customer can be aggregated into a single service provider's VLAN (using the outer VLAN tag defined by SP VID).

**Note:** Static VLAN **Tx Tagging** MUST be enabled on a port where you choose **Tunnel Port**.

## 21.3 VLAN Tag Format

A VLAN tag (service provider VLAN stacking or customer IEEE 802.1Q) consists of the following three fields.

**Table 48** VLAN Tag Format

| Type | Priority | VID |
|---|---|---|

**Type** is a standard Ethernet type code identifying the frame and indicates that whether the frame carries IEEE 802.1Q tag information. **SP TPID** (Service Provider Tag Protocol Identifier) is the service provider VLAN stacking tag type. Many vendors use 0x8100 or 0x9100.

**TPID** (Tag Protocol Identifier) is the customer IEEE 802.1Q tag.

- If the VLAN stacking port role is **Access Port**, then the switch adds the **SP TPID** tag to all incoming frames on the service provider's edge devices (1 and 2 in the VLAN stacking example figure).
- If the VLAN stacking port role is **Tunnel Port**, then the switch only adds the **SP TPID** tag to all incoming frames on the service provider's edge devices (1 and 2 in the VLAN stacking example figure) that have an **SP TPID** different to the one configured on the switch. (If an incoming frame's **SP TPID** is the same as the one configured on the switch, then the switch will not add the tag.)

**Priority** refers to the IEEE 802.1p standard that allows the service provider to prioritize traffic based on the class of service (CoS) the customer has paid for.

- On the switch, configure priority level of inner IEEE 802.1Q tag in the **Port Setup** screen.
- "0" is the lowest priority level and "7" is the highest.

**VID** is the VLAN ID. **SP VID** is the VID for the second (service provider's) VLAN tag.

## 21.3.1 Frame Format

The frame format for an untagged Ethernet frame, a single-tagged 802.1Q frame (customer) and a "double-tagged" 802.1Q frame (service provider) is shown next.

Configure the fields as circled in the switch **VLAN Stacking** screen.

**Table 49** Single and Double Tagged 802.11Q Frame Format

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | DA | SA | Len/Etype | Data | FCS | Untagged Ethernet frame |
| | | | DA | SA | **TPID** | **Priority** | **VID** | Len/Etype | Data | FCS | IEEE 802.1Q customer tagged frame |
| DA | SA | **SPTPID** | **Priority** | **VID** | **TPID** | **Priority** | **VID** | Len/Etype | Data | FCS | Double-tagged frame |

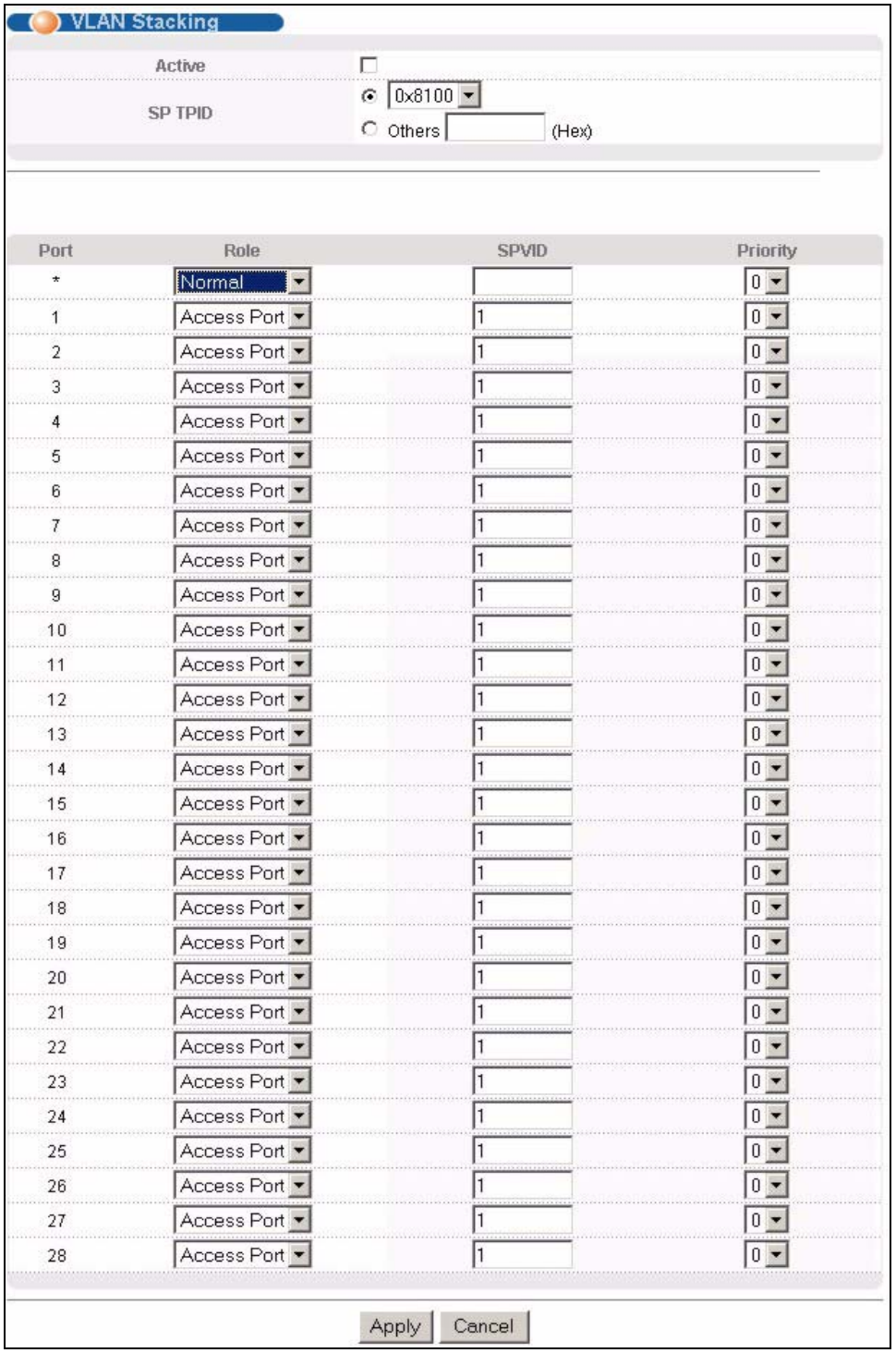
**Table 50** 802.1Q Frame

| | | | |
|---|---|---|---|
| DA | Destination Address | Priority | 802.1p Priority |
| SA | Source Address | Len/Etype | Length and type of Ethernet frame |
| (SP)TPID | (Service Provider) Tag Protocol IDentifier | Data | Frame data |
| VID | VLAN ID | FCS | Frame Check Sequence |

# 21.4 Configuring VLAN Stacking

Click **Advanced Applications** and then **VLAN Stacking** to display the screen as shown.

**Figure 69** VLAN Stacking



The following table describes the labels in this screen.

**Table 51** VLAN Stacking

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this checkbox to enable VLAN stacking on the switch. |
| SP TPID | **SP TPID** is a standard Ethernet type code identifying the frame and indicates whether the frame carries IEEE 802.1Q tag information. Choose **0x8100** or **0x9100** from the drop-down list box or select **Others** and then enter a four-digit hexadecimal number from 0x0000 to 0xFFFF. 0x denotes a hexadecimal number. It does not have to be typed in the **Others** text field. |
| Port | The port number identifies the port you are configuring. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Role | Select **Normal** to have the switch ignore frames received (or transmitted) on this port with VLAN stacking tags. Anything you configure in **SPVID** and **Priority** are ignored.<br>Select **Access Port** to have the switch add the **SP TPID** tag to all incoming frames received on this port. Select **Access Port** for ingress ports at the edge of the service provider's network.<br>Select **Tunnel Port** (available for Gigabit ports only) for egress ports at the edge of the service provider's network.<br>In order to support VLAN stacking on a port, the port must be able to allow frames of 1526 Bytes (1522 Bytes + 4 Bytes for the second tag) to pass through it. |
| SPVID | **SPVID** is the service provider's VLAN ID (the outer VLAN tag). Enter the service provider ID (from 1 to 4094) for frames received on this port. See Chapter 8 on page 85 for more background information on VLAN ID. |
| Priority | On the switch, configure priority level of inner IEEE 802.1Q tag in the **Port Setup** screen.<br>"0" is the lowest priority level and "7" is the highest. |
| Apply | Click **Apply** to save your changes back to the switch. |
| Cancel | Click **Cancel** to begin configuring this screen afresh. |

# CHAPTER 22
# Multicast

This chapter shows you how to configure various multicast features.

## 22.1 Multicast Overview

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender to 1 recipient) or Broadcast (1 sender to everybody on the network). Multicast delivers IP packets to just a group of hosts on the network.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group - it is not used to carry user data. Refer to RFC 1112 and RFC 2236 for information on IGMP versions 1 and 2 respectively.

### 22.1.1 IP Multicast Addresses

In IPv4, a multicast address allows a device to send packets to a specific group of hosts (multicast group) in a different subnetwork. A multicast IP address represents a traffic receiving group, not individual receiving devices. IP addresses in the Class D range (224.0.0.0 to 239.255.255.255) are used for IP multicasting. Certain IP multicast numbers are reserved by IANA for special purposes (see the IANA web site for more information).

### 22.1.2 IGMP Filtering

With the IGMP filtering feature, you can control which IGMP groups a subscriber on a port can join. This allows you to control the distribution of multicast services (such as content information distribution) based on service plans and types of subscription.

You can set the switch to filter the multicast group join reports on a per-port basis by configuring an IGMP filtering profile and associating the profile to a port.

### 22.1.3 IGMP Snooping

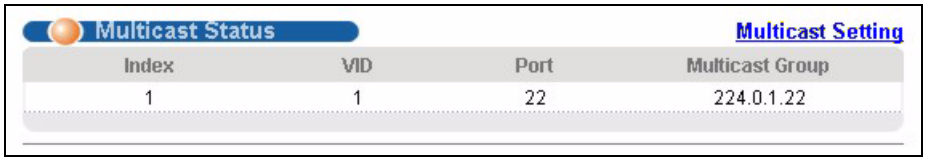
A switch can passively snoop on IGMP Query, Report and Leave (IGMP version 2) packets transferred between IP multicast routers/switches and IP multicast hosts to learn the IP multicast group membership. It checks IGMP packets passing through it, picks out the group registration information, and configures multicasting accordingly. IGMP snooping allows the switch to learn multicast groups without you having to manually configure them.

The switch forwards multicast traffic destined for multicast groups (that it has learned from IGMP snooping or that you have manually configured) to ports that are members of that group. IGMP snooping generates no additional network traffic, allowing you to significantly reduce multicast traffic passing through your switch.

## 22.2 Multicast Status

Click **Advanced Applications** and **Multicast** to display the screen as shown. This screen shows the multicast group information. See Section 22.1 on page 169 for more information on multicasting.

**Figure 70** Multicast Status.




The following table describes the labels in this screen.

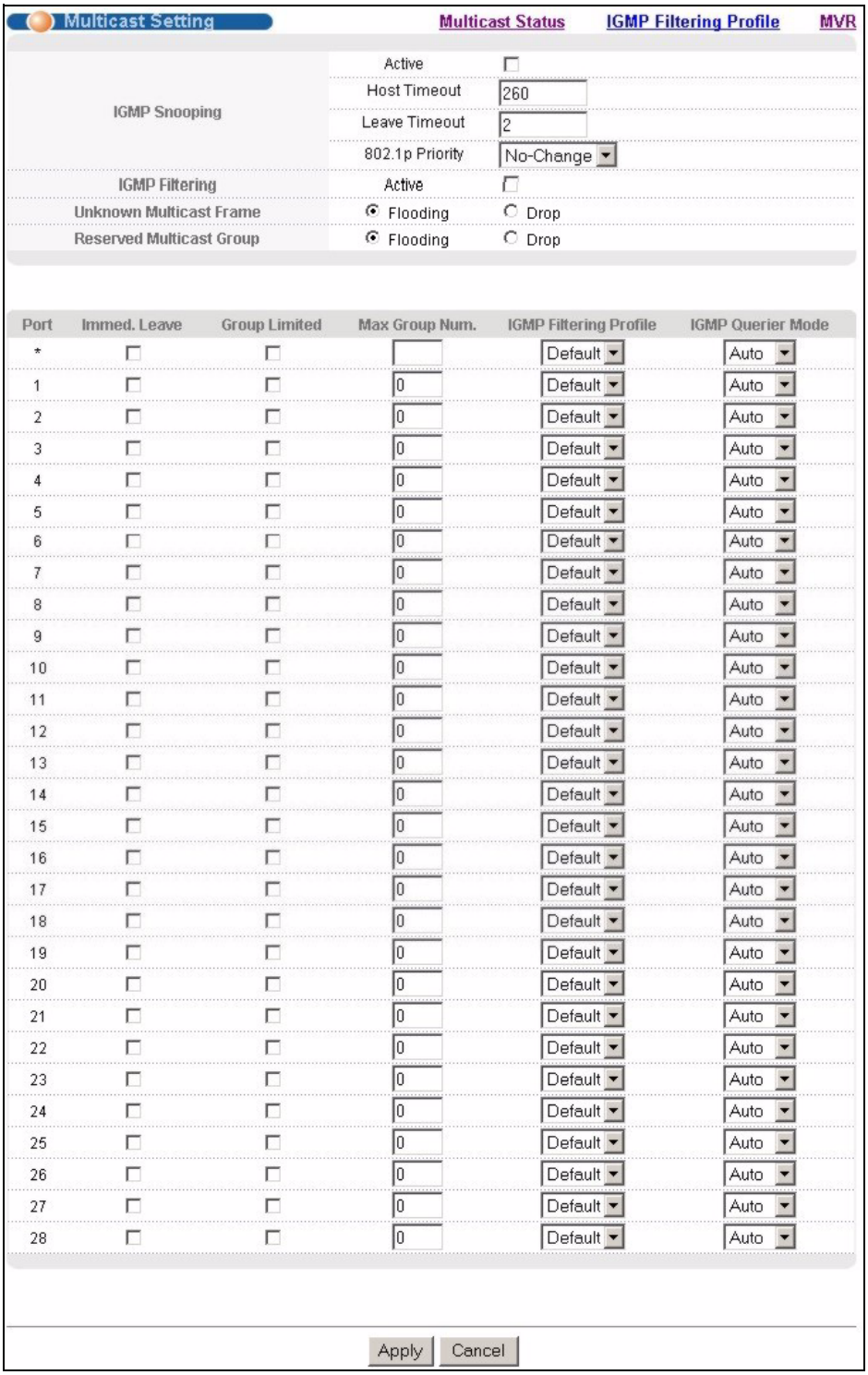
**Table 52** Multicast Status

| LABEL | DESCRIPTION |
|---|---|
| Index | This is the index number of the entry. |
| VID | This field displays the multicast VLAN ID. |
| Port | This field displays the port number that belongs to the multicast group. |
| Multicast Group | This field displays IP multicast group addresses. |

## 22.3 Multicast Setting

Click **Advanced Applications**, **Multicast** and the **Multicast Setting** link to display the screen as shown. See Section 22.1 on page 169 for more information on multicasting.

Multicast Setting



The following table describes the labels in this screen.

**Table 53** Multicast Setting

| LABEL | DESCRIPTION |
|---|---|
| IGMP Snooping | Use thise settings to configure IGMP Snooping. |
| Active | Select **Active** to enable IGMP Snooping to forward group multicast traffic only to ports that are members of that group. |
| Host Timeout | Specify the time (from 1 to 16,711,450) in seconds that elapses before the switch removes an IGMP group membership entry if it does not receive report messages from the port. |
| Leave Timeout | Enter an IGMP leave timeout value (from 1 to 16,711,450) in seconds. This defines how many seconds the switch waits for an IGMP report before removing an IGMP snooping membership entry when an IGMP leave message is received from a host. |
| 802.1p Priority | Select a priority level (0-7) to which the switch changes the priority in outgoing IGMP control packets. Otherwise, select **No-Change** to not replace the priority. |
| IGMP Filtering | Select **Active** to enable IGMP filtering to control which IGMP groups a subscriber on a port can join. |
| Unknown Multicast Frame | Specify the action to perform when the switch receives an unknown multicast frame. Select **Drop** to discard the frame(s). Select **Flooding** to send the frame(s) to all ports. |
| Reserved Multicast Group | Multicast addresses (224.0.0.0 to 224.0.0.255) are reserved for the local scope. For examples, 224.0.0.1 is for all hosts in this subnet, 224.0.0.2 is for all multicast routers in this subnet, etc. A router will not forward a packet with the destination IP address within this range. See the IANA web site for more information.<br>Specify the action to perform when the switch receives a frame with a reserved multicast address. Select **Drop** to discard the frame(s). Select **Flooding** to send the frame(s) to all ports. |
| Port | This field displays the port number. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Immed. Leave | Select this option to set the switch to remove this port from the multicast tree when an IGMP version 2 leave message is received on this port.<br>Select this option if there is only one host connected to this port. |
| Group Limited | Select this option to limit the number of multicast groups this port is allowed to join. |
| Max Group Num. | Enter the number of multicast groups this port is allowed to join. Once a port is registered in the specified number of multicast groups, any new IGMP join report frame(s) is dropped on this port. |
| IGMP Filtering Profile | Select the name of the IGMP filtering profile to use for this port. Otherwise, select **Default** to prohibit the port from joining any multicast group. |

**Table 53** Multicast Setting (continued)

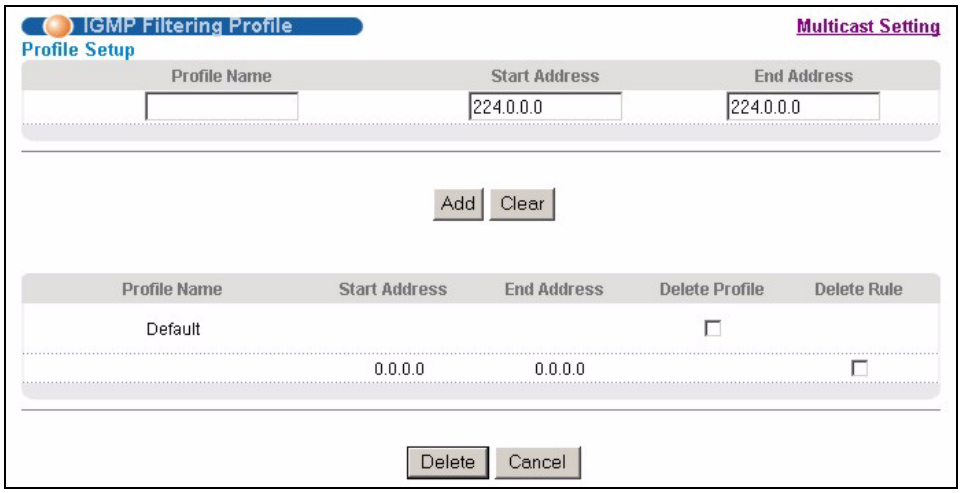
| LABEL | DESCRIPTION |
|---|---|
| IGMP Querier Mode | The switch treats an IGMP query port as being connected to an IGMP multicast router (or server). The switch forwards IGMP join or leave packets to an IGMP query port.<br>Select **Auto** to have the switch use the port as an IGMP query port if the port receives IGMP query packets.<br>Select **Fixed** to have the switch always use the port as an IGMP query port. Select this when you connect an IGMP multicast server to the port.<br>Select **Edge** to stop the switch from using the port as an IGMP query port. The switch will not keep any record of an IGMP router being connected to this port. The switch does not forward IGMP join or leave packets to this port. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 22.4 IGMP Filtering Profile

IGMP filter profiles allow you to control access to IGMP multicast groups. This allows you to have a service available to a specific IGMP multicast group. You can configure an IGMP filter profile for an IGMP multicast group that has access to a service (like a SIP server for example). Within a profile, configure an IGMP filter to specify the multicast IP address ranges. Then assign the IGMP filter profile to the ports (in the **Multicast Setting** screen) that are allowed to use the service.

Click **Advanced Applications** and **Multicast** in the navigation panel. Click the **Multicast Setting** link and then the **IGMP Filtering Profile** link to display the screen as shown.

**Figure 71** Multicast: IGMP Filtering Profile




The following table describes the labels in this screen.

**Table 54** Multicast: IGMP Filtering Profile

| LABEL | DESCRIPTION |
|---|---|
| Profile Name | Enter a descriptive name for the profile for identification purposes.<br>To configure additional rule(s) for a profile that you have already added, enter the profile name and specify a different IP multicast address range. |
| Start Address | Type the starting multicast IP address for a range of multicast IP addresses that you want to belong to the IGMP filter profile. |
| End Address | Type the ending multicast IP address for a range of IP addresses that you want to belong to the IGMP filter profile.<br>If you want to add a single multicast IP address, enter it in both the **Start Address** and **End Address** fields. |
| Add | Click **Add** to save the settings to the switch. |
| Clear | Click **Clear** to clear the fields to the factory defaults. |
| Profile Name | This field displays the descriptive name of the profile. |
| Start Address | This field displays the start of the multicast address range. |
| End Address | This field displays the end of the multicast address range. |
| Delete | To delete the profile(s) and all the accompanying rules, select the profile(s) that you want to remove in the **Delete Profile** column, then click the **Delete** button.<br>To delete a rule(s) from a profile, select the rule(s) that you want to remove in the **Delete Rule** column, then click the **Delete** button. |
| Cancel | Click **Cancel** to clear the **Delete Profile**/**Delete Rule** check boxes. |

## 22.5 MVR Overview

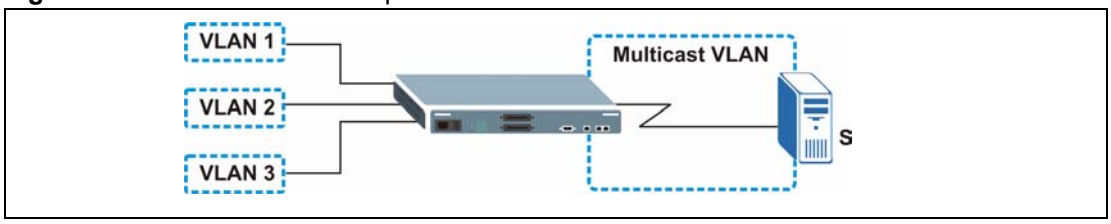
Multicast VLAN Registration (MVR) is designed for applications (such as Media-on-Demand (MoD)) that use multicast traffic across an Ethernet ring-based service provider network.

MVR allows one single multicast VLAN to be shared among different subscriber VLANs on the network. While isolated in different subscriber VLANs, connected devices can subscribe to and unsubscribe from the multicast stream in the multicast VLAN. This improves bandwidth utilization with reduced multicast traffic in the subscriber VLANs and simplifies multicast group management.

You must enable IGMP snooping to use MVR. However, MVR only responds to IGMP join and leave control messages from multicast groups that are configured under MVR. Join and leave reports from other multicast groups are managed by IGMP snooping.

The following figure shows a network example. The subscriber VLAN (**1**, **2** and **3**) information is hidden from the streaming media server, **S**. In addition, the multicast VLAN information is only visible to the switch and **S**.

**Figure 72** MVR Network Example




### 22.5.1 Types of MVR Ports

In MVR, a source port is a port on the switch that can send and receive multicast traffic in a multicast VLAN while a receiver port can only receive multicast data. Once configured, the switch maintains a forwarding table that matches the multicast stream to the associated multicast group.

### 22.5.2 MVR Modes

You can set your switch to operate in either dynamic or compatible mode.

In dynamic mode, the switch sends IGMP leave and join reports to the other multicast devices (such as multicast routers or servers) in the multicast VLAN. This allows the multicast devices to update the multicast forwarding table to forward or not forward multicast traffic to the receiver ports.

In compatible mode, the switch does not send any IGMP reports. In this case, you must manually configure the forwarding settings on the multicast devices in the multicast VLAN.

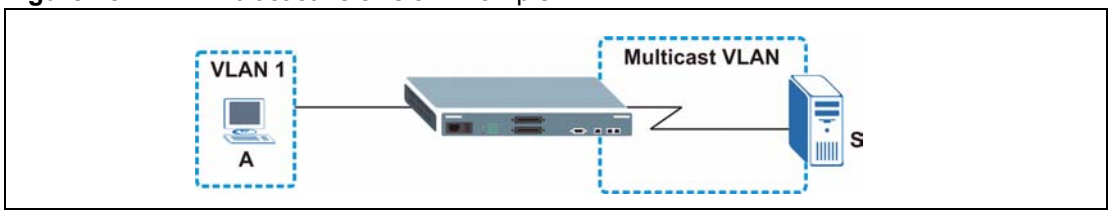
### 22.5.3 How MVR Works

The following figure shows a multicast television example where a subscriber device (such as a computer) in VLAN 1 receives multicast traffic from the streaming media server, **S**, via the switch. Multiple subscriber devices can connect through a port configured as the receiver on the switch.

When the subscriber selects a television channel, computer **A** sends an IGMP report to the switch to join the appropriate multicast group. If the IGMP report matches one of the configured MVR multicast group addresses on the switch, an entry is created in the forwarding table on the switch. This maps the subscriber VLAN to the list of forwarding destinations for the specified multicast traffic.

When the subscriber changes the channel or turns off the computer, an IGMP leave message is sent to the switch to leave the multicast group. The switch sends a query to VLAN 1 on the receiver port (in this case, a DSL port on the switch). If there is another subscriber device connected to this port in the same subscriber VLAN, the receiving port will still be on the list of forwarding destination for the multicast traffic. Otherwise, the switch removes the receiver port from the forwarding table.

**Figure 73** MVR Multicast Television Example



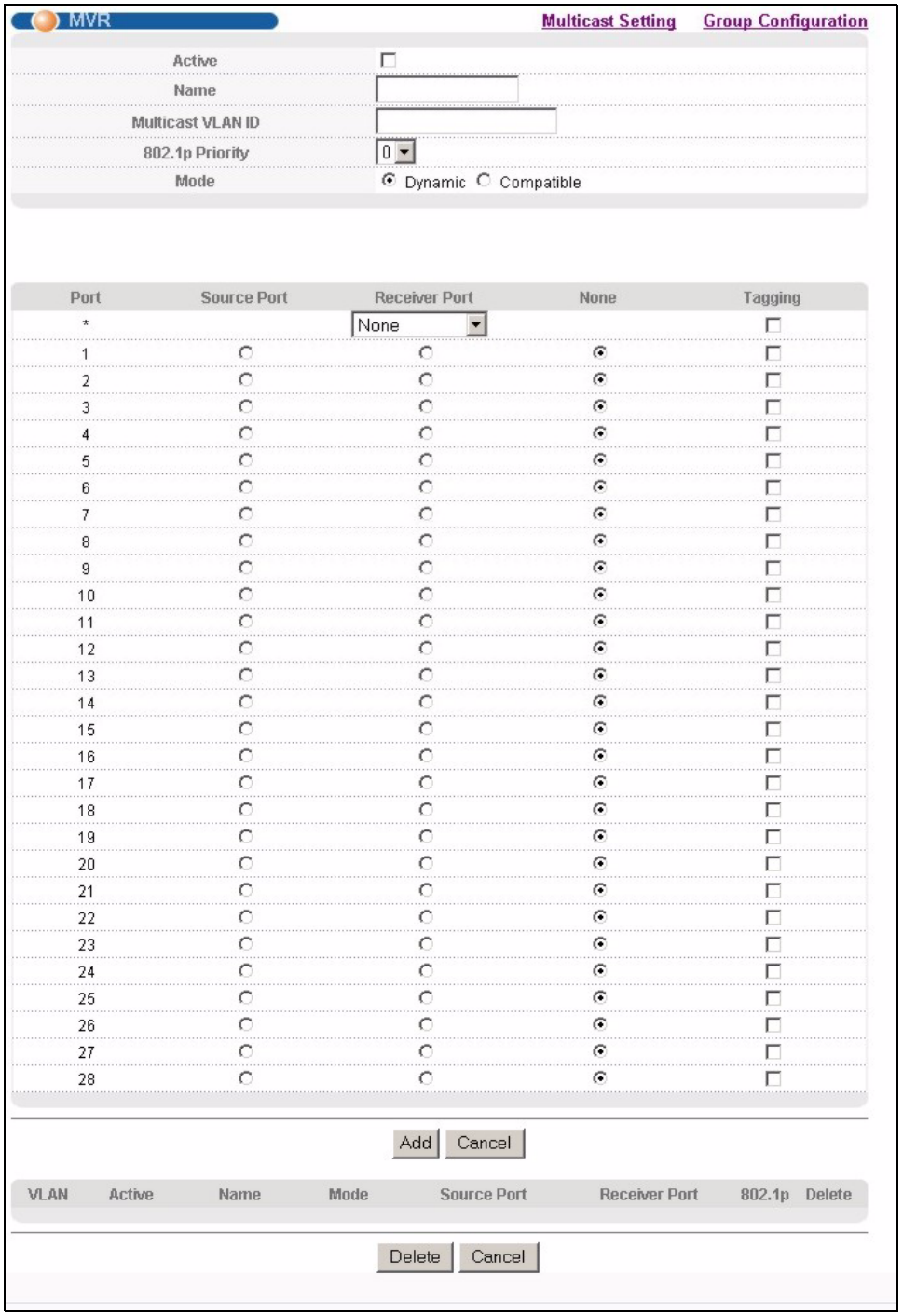

## 22.6 General MVR Configuration

Use the **MVR** screen to create multicast VLANs and select the receiver port(s) and a source port for each multicast VLAN. Click **Advanced Applications** and **Multicast** in the navigation panel. Click the **Multicast Setting** link and then the **MVR** link to display the screen as shown next.

**Note:** You can create up to three multicast VLANs and up to 256 multicast rules on the switch.

Your switch automatically creates a static VLAN (with the same VID) when you create a multicast VLAN in this screen.

**Figure 74** MVR



The following table describes the related labels in this screen.

**Table 55** MVR

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to enable MVR to allow one single multicast VLAN to be shared among different subscriber VLANs on the network. |
| Name | Enter a descriptive name (up to 32 printable ASCII characters) for identification purposes. |
| Multicast VLAN ID | Enter the VLAN ID (1 to 4094) of the multicast VLAN. |
| 802.1p Priority | Select a priority level (0-7) with which the switch replaces the priority in outgoing IGMP control packets (belonging to this multicast VLAN). |
| Mode | Specify the MVR mode on the switch. Choices are **Dynamic** and **Compatible**.<br>Select **Dynamic** to send IGMP reports to all MVR source ports in the multicast VLAN.<br>Select **Compatible** to set the switch not to send IGMP reports. |
| Port | This field displays the port number on the switch. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Source Port | Select this option to set this port as the MVR source port that sends and receives multicast traffic. All source ports must belong to a single multicast VLAN. |
| Receiver Port | Select this option to set this port as a receiver port that only receives multicast traffic. |
| None | Select this option to set the port not to participate in MVR. No MVR multicast traffic is sent or received on this port. |
| Tagging | Select this checkbox if you want the port to tag the VLAN ID in all outgoing frames transmitted. |
| Add | Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| VLAN | This field displays the multicast VLAN ID. |
| Active | This field displays whether the multicast group is enabled or not. |
| Name | This field displays the descriptive name for this setting. |
| Mode | This field displays the MVR mode. |
| Source Port | This field displays the source port number(s). |
| Receiver Port | This field displays the receiver port number(s). |
| 802.1p | This field displays the priority level. |
| Delete | To delete a multicast VLAN(s), select the rule(s) that you want to remove in the **Delete** column, then click the **Delete** button. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

# 22.7 MVR Group Configuration

All source ports and receiver ports belonging to a multicast group can receive multicast data sent to this multicast group.

Configure MVR IP multicast group address(es) in the **Group Configuration** screen. Click **Group Configuration** in the **MVR** screen.

**Note:** A port can belong to more than one multicast VLAN. However, IP multicast group addresses in different multicast VLANs cannot overlap.

**Figure 75** MVR: Group Configuration

The following table describes the labels in this screen.

**Table 56** MVR: Group Configuration

| LABEL | DESCRIPTION |
|---|---|
| Multicast VLAN ID | Select a multicast VLAN ID (that you configured in the **MVR** screen) from the drop-down list box. |
| Name | Enter a descriptive name for identification purposes. |
| Start Address | Enter the starting IP multicast address of the multicast group in dotted decimal notation.<br>Refer to Section 22.1.1 on page 169 for more information on IP multicast addresses. |
| End Address | Enter the ending IP multicast address of the multicast group in dotted decimal notation.<br>Enter the same IP address as the **Start Address** field if you want to configure only one IP address for a multicast group.<br>Refer to Section 22.1.1 on page 169 for more information on IP multicast addresses. |
| Add | Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

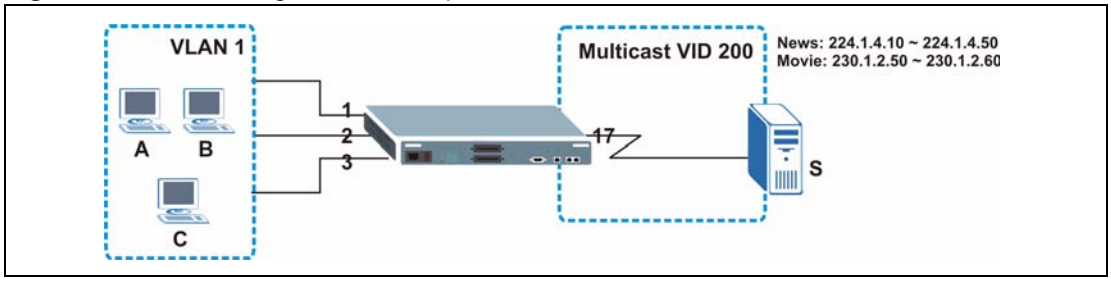
**Table 56** MVR: Group Configuration

| LABEL | DESCRIPTION |
|---|---|
| MVLAN | This field displays the multicast VLAN ID. |
| Name | This field displays the descriptive name for this setting. |
| Start Address | This field displays the starting IP address of the multicast group. |
| End Address | This field displays the ending IP address of the multicast group. |
| Delete | Select **Delete Group** and click **Delete** to remove the selected entry(ies) from the table. |
| Cancel | Select **Cancel** to clear the checkbox(es) in the table. |

## 22.7.1 MVR Configuration Example

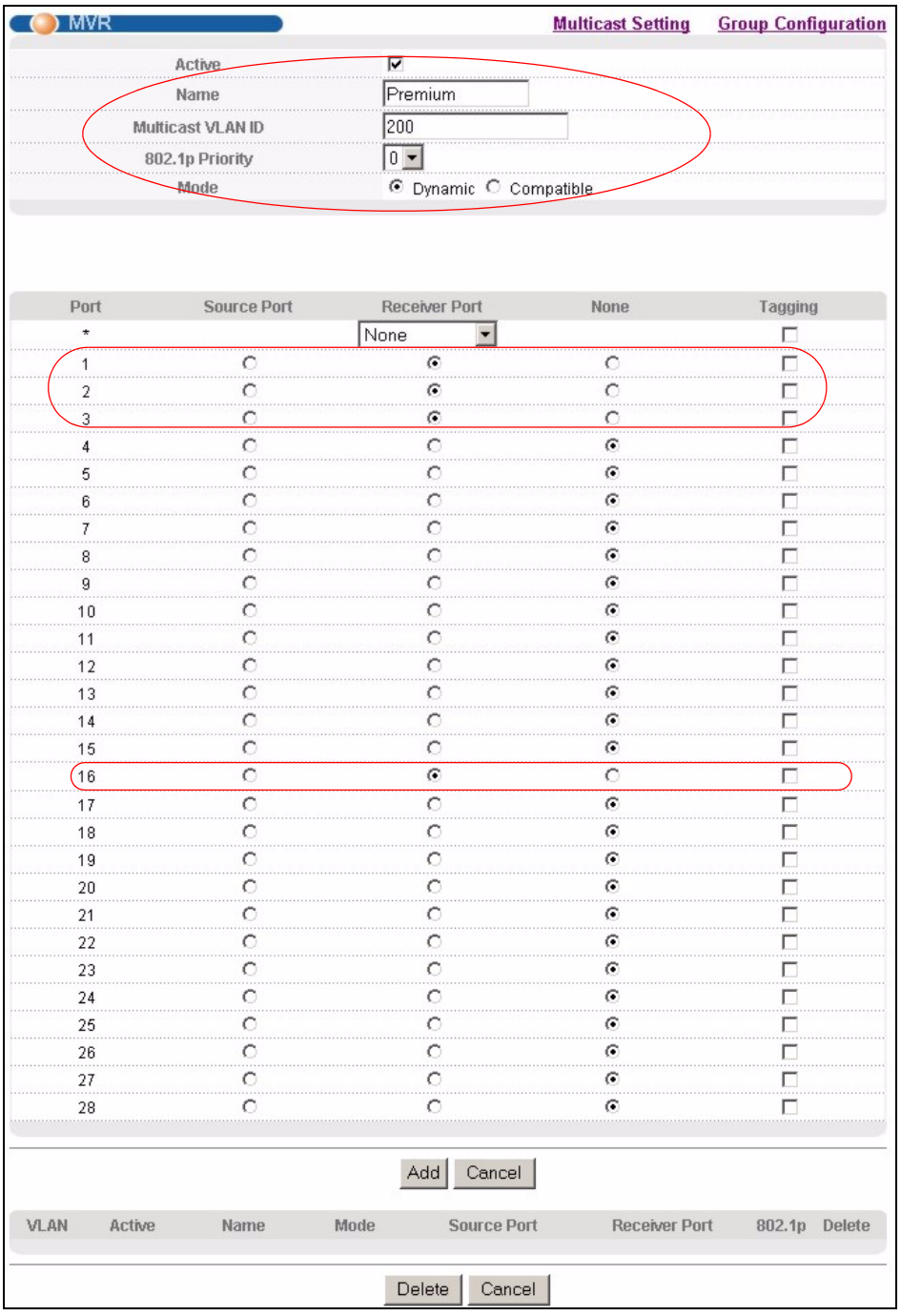
The following figure shows a network example where ports 1, 2 and 3 on the switch belong to VLAN 1. In addition, port 17 belongs to the multicast group with VID 200 to receive multicast traffic (the **News** and **Movie** channels) from the remote streaming media server, **S**. Computers **A**, **B** and **C** in VLAN are able to receive the traffic.

**Figure 76** MVR Configuration Example




To configure the MVR settings on the switch, create a multicast group in the **MVR** screen and set the receiver and source ports.

**Figure 77** MVR Configuration Example




To set the switch to forward the multicast group traffic to the subscribers, configure multicast group settings in the **Group Configuration** screen. The following figure shows an example where two multicast groups (**News** and **Movie**) are configured for the multicast VLAN 200.

**Figure 78** MVR Group Configuration Example

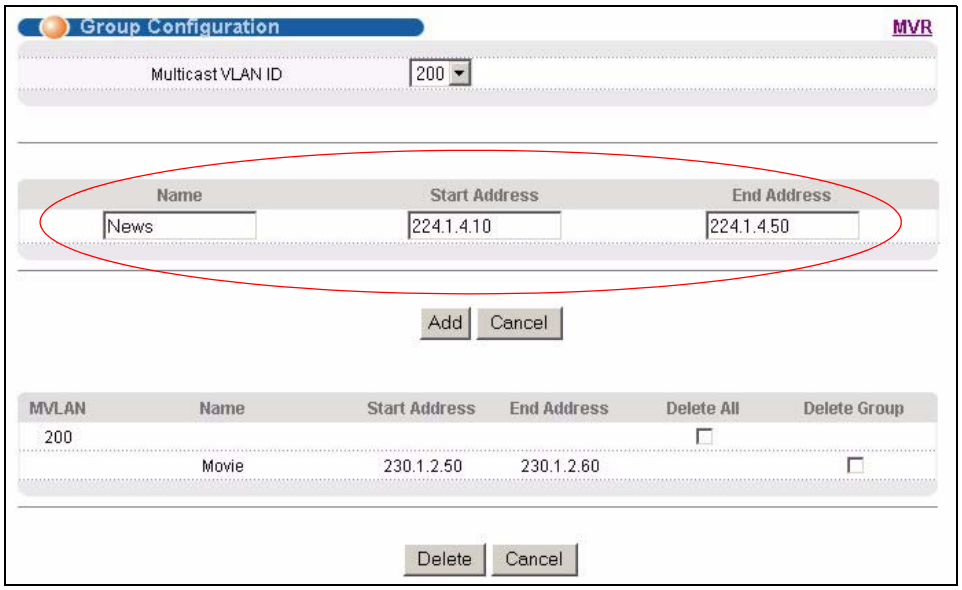
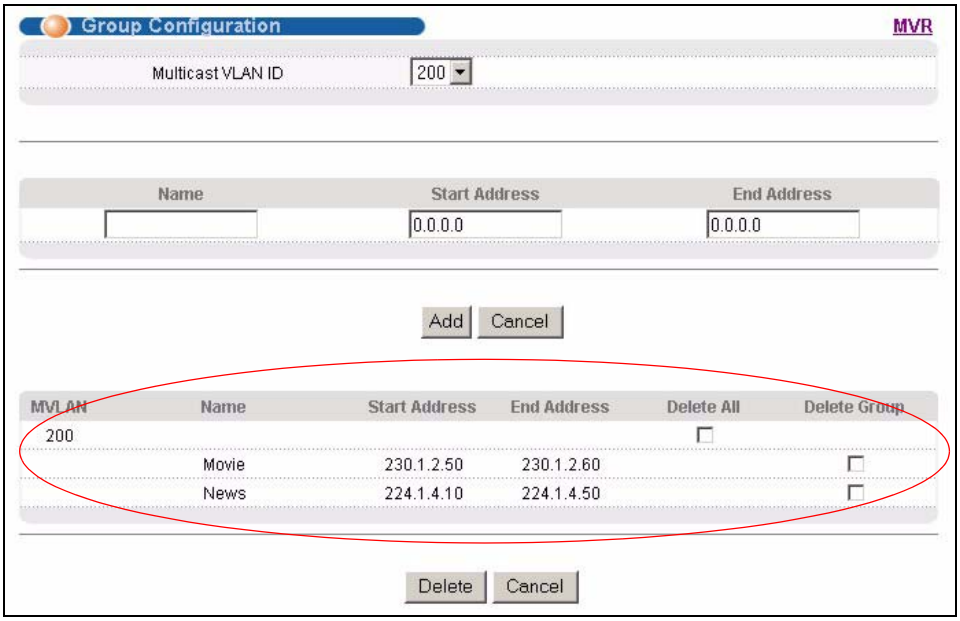



**Figure 79** MVR Group Configuration Example



# CHAPTER 23
# DHCP Relay

This chapter shows you how to set up DHCP relay.

## 23.1 DHCP Relay Overview

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a DHCP server. You can configure the switch to relay client DHCP requests to a DHCP server and the server's responses back to the clients.

### 23.1.1 DHCP Relay Agent Information

The switch can add information to client DHCP requests that it relays to a DHCP server. This helps provide authentication about the source of the requests. You can also specify additional information for the switch to add to the client DHCP requests that it relays to the DHCP server. Please refer to RFC 3046 for more details.

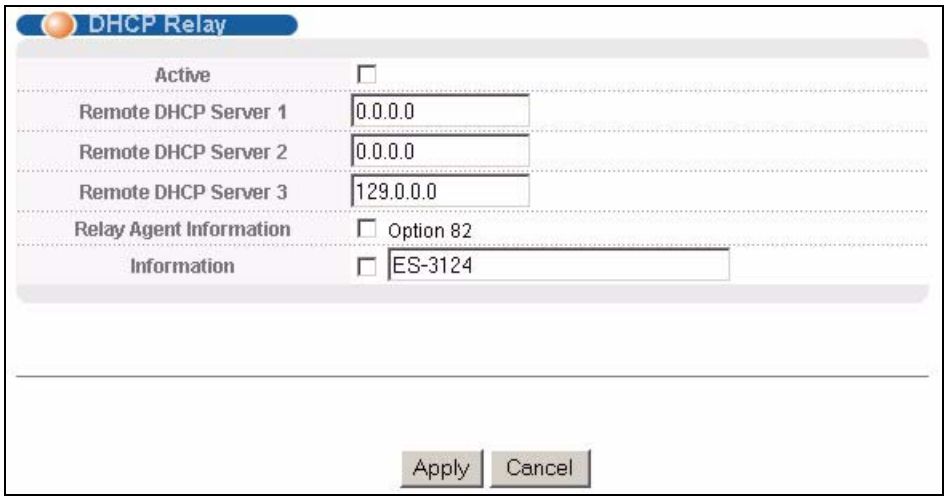
The DHCP relay agent information feature adds an Agent Information field to the option 82 field of the DHCP headers of client TCP/IP configuration request frames that the switch relays to a DHCP server. The following lists the DHCP relay agent option 82 information that the switch sends to the DHCP server:

- Slot ID (1 byte)
- Port ID (1 byte)
- VLAN ID (2 bytes)
- System name (up to 32 bytes, this is optional).

## 23.2 DHCP Relay Configuration

To configure DHCP relay information and specify the DHCP server(s), click **Advanced Application** and **DHCP Relay** to display the screen as shown next.

**Figure 80** DHCP Relay




The following table describes the labels in this screen.

**Table 57** DHCP Relay

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to enable DHCP relay. |
| Remote DHCP Server 1 .. 3 | Enter the IP address of a DHCP server in dotted decimal notation. |
| Relay Agent Information | Select the **Option 82** check box to have the switch add information (slot number, port number and VLAN ID) to client DHCP requests that it relays to a DHCP server. |
| Information | This read-only field displays the system name you configure in the General Setup screen.<br>Select the check box for the switch to add the system name to the DHCP client DHCP requests that it relays to a DHCP server. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 24
# Static Route

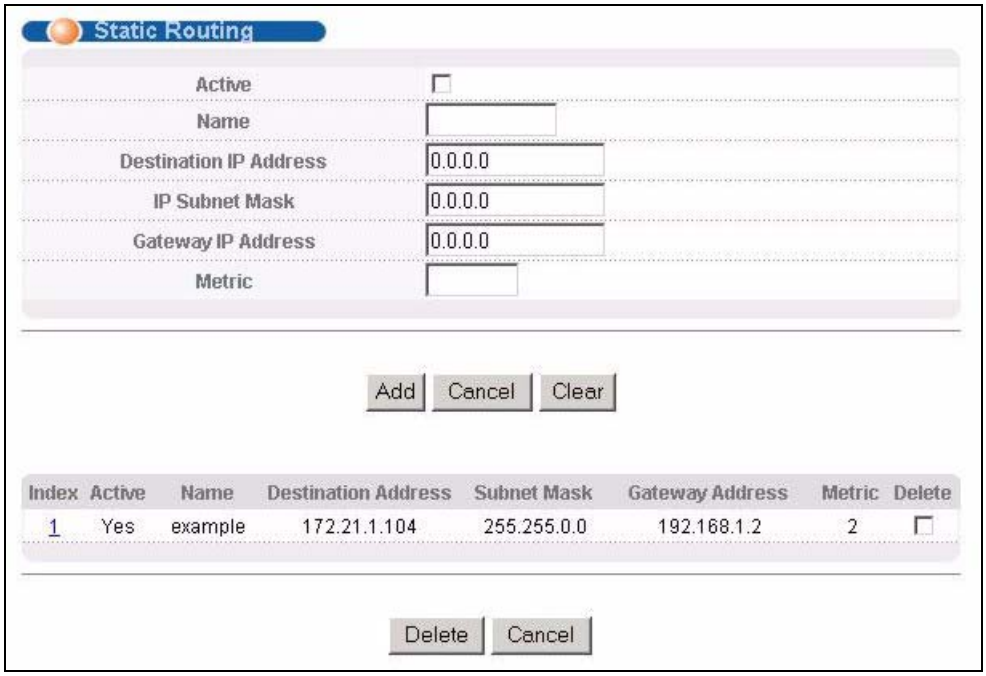
This chapter shows you how to configure static routes.

## 24.1 Configuring Static Route

Static routes tell the switch how to forward IP traffic when you configure the TCP/IP parameters manually.

Click **IP Application**, **Static Routing** in the navigation panel to display the screen as shown.

**Figure 81** Static Routing




The following table describes the related labels you use to create a static route.

**Table 58** Static Routing

| LABEL | DESCRIPTION |
|---|---|
| Active | This field allows you to activate/deactivate this static route. |
| Name | Enter a descriptive name (up to 32 printable ASCII characters) for identification purposes. |

**Table 58** Static Routing (continued)

| LABEL | DESCRIPTION |
|---|---|
| Destination IP Address | This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID. |
| IP Subnet Mask | Enter the subnet mask for this destination. |
| Gateway IP Address | Enter the IP address of the gateway. The gateway is an immediate neighbor of your switch that will forward the packet to the destination. The gateway must be a router on the same segment as your switch. |
| Metric | The metric represents the "cost" of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. Enter a number that approximates the cost for this link. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number. |
| Add | Click **Add** to save your static route to the the switch's run-time memory. The switch discards this route if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Clear | Click **Clear** to set the above fields back to the factory defaults. |
| Index | This field displays the index number of the route. Click a number to edit the static route entry. |
| Active | This field displays **Yes** when the static route is activated and **NO** when it is deactivated. |
| Name | This field displays the descriptive name for this route. This is for identification purpose only. |
| Destination Address | This field displays the IP network address of the final destination. |
| Subnet Mask | This field displays the subnet mask for this destination. |
| Gateway Address | This field displays the IP address of the gateway. The gateway is an immediate neighbor of your switch that will forward the packet to the destination. |
| Metric | This field displays the cost of transmission for routing purposes. |
| Delete | Click **Delete** to remove the selected entry from the summary table. |
| Cancel | Click **Cancel** to clear the **Delete** check boxes. |

# CHAPTER 25
# DiffServ Code Point

This chapter shows you how to set up Diffserv Code Point (DSCP) on each port and how to convert DSCP values to IEEE 802.1p values.

## 25.1 DiffServ Overview

DiffServ Code Point (DSCP) is a field used for packet classification on DiffServ networks. The higher the value, the higher the priority. Lower-priority packets may be dropped if the total traffic exceeds the capacity of the network.

## 25.2 Enable DiffServ

Click **IP Application**, **DiffServ** in the navigation panel to display the screen as shown.

**Figure 82** DiffServ

The following table describes the related labels you use to create a static route.

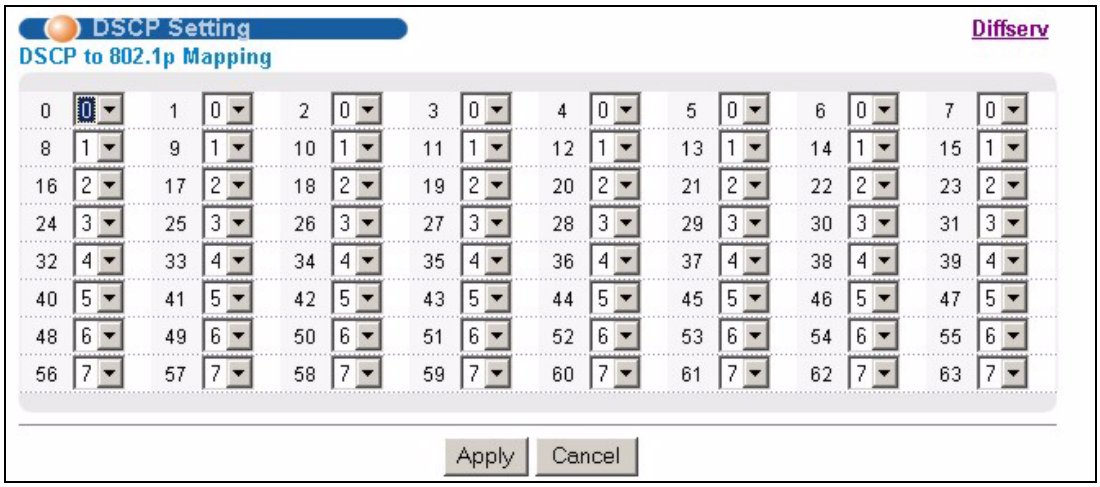
**Table 59** Static Routing

| LABEL | DESCRIPTION |
|---|---|
| DSCP Setting | Click DSCP Map to open the screen where you can set up the mapping between source DSCP priority and IEEE 802.1p priority. |
| Active | This field allows you to activate/deactivate DiffServ on the switch. |
| Port | This read-only index number indicates which port you are activating. |
| * | Settings in this row apply to all ports.<br>Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis.<br>**Note:** Changes in this row are copied to all the ports as soon as you make them. |
| Active | This allows you to activate DiffServ on a per port basis. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 25.3 Configure DSCP Setting

Use this screen to convert DSCP priority to IEEE 802.1p priority. Click **IP Application**, **DiffServ, DSCP** in the navigation panel to display the screen as shown.

**Figure 83** DiffServ




The following table describes the related labels you use to create a static route.

**Table 60** Static Routing

| LABEL | DESCRIPTION |
|---|---|
| Diffserv | Click this to return to the main DiffServ screen. |
| DSCP to 802.1p Mapping | In this section you map each DSCP value with an 802.1p value in the drop down list box. |
| 0-63 | This field displays each DSCP value. |
| 802.1p Priority | Use the drop down list box to select the IEEE 802.1p priority (0 to 7) to which you would like to map this DSCP value. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

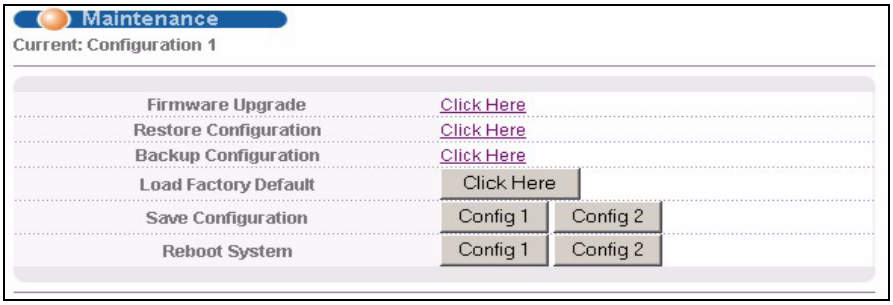
# CHAPTER 26
# Maintenance

This chapter explains how to configure the maintenance screens that let you maintain the firmware and configuration files.

## 26.1 The Maintenance Screen

Click **Management**, **Maintenance** in the navigation panel to open the following screen.

**Figure 84** Maintenance




The following table describes the labels in this screen.

**Table 61** Maintenance

| LABEL | DESCRIPTION |
|---|---|
| Current | This field displays which configuration (**Configuration 1** or **Configuration 2**) is currently operating on the switch. |
| Firmware Upgrade | Click **Click Here** to go to the **Firmware Upgrade** screen. |
| Restore Configuration | Click **Click Here** to go to the **Restore Configuration** screen. |
| Backup Configuration | Click **Click Here** to go to the **Backup Configuration** screen. |
| Load Factory Default | Click **Click Here** to reset the configuration to the factory default settings. |

**Table 61** Maintenance (continued)

| LABEL | DESCRIPTION |
|---|---|
| Save Configuration | Click **Config 1** to save the current configuration settings to **Configuration 1** on the switch.<br>Click **Config 2** to save the current configuration settings to **Configuration 2** on the switch. |
| Reboot System | Click **Config 1** to reboot the system and load **Configuration 1** on the switch.<br>Click **Config 2** to reboot the system and load **Configuration 2** on the switch.<br>**Note:** Make sure to click the **Save** button in any screen to save your settings to the current configuration on the switch. |

## 26.2 Load Factory Defaults

Follow the steps below to reset the switch back to the factory defaults.

1. In the **Maintenance** screen, click the **Click Here** button next to **Load Factory Defaults** to clear all switch configuration information you configured and return to the factory defaults.
2. Click **OK** to reset all switch configurations to the factory defaults .

**Figure 85** Load Factory Default: Start

3. In the web configurator, click the **Save** button to make the changes take effect. If you want to access the switch web configurator again, you may need to change the IP address of your computer to be in the same subnet as that of the default switch IP address (192.168.1.1).

## 26.3 Save Configuration

Click **Config 1** to save the current configuration settings permanently to **Configuration 1** on the switch.

Click **Config 2** to save the current configuration settings to **Configuration 2** on the switch.

Alternatively, click Save on the top right-hand corner in any screen to save the configuration changes to the current configuration.

**Note:** Note: Clicking the Apply or Add button does NOT save the changes permanently.

All unsaved changes are erased after you reboot the switch.

## 26.4 Reboot System

**Reboot System** allows you to restart the switch without physically turning the power off. It also allows you to load configuration one (**Config 1**) or configuration two (**Config 2**) when you reboot. Follow the steps below to reboot the switch.

1 In the **Maintenance** screen, click the **Config 1** button next to **Reboot System** to reboot and load configuration one. The following screen displays.

**Figure 86** Reboot System: Confirmation

2 Click **OK** again and then wait for the switch to restart. This takes up to two minutes. This does not affect the switch's configuration.

Click **Config 2** and follow steps 1 to 2 to reboot and load configuration two on the switch.

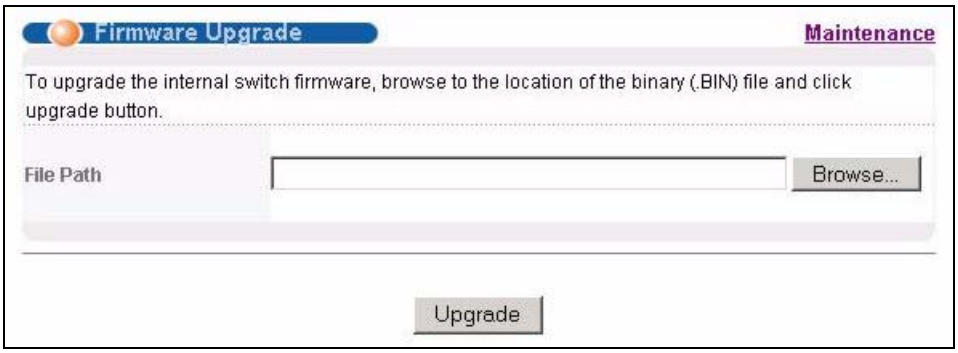
## 26.5 Firmware Upgrade

Make sure you have downloaded (and unzipped) the correct model firmware and version to your computer before uploading to the device.

**Note:** Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your device.

From the **Maintenance** screen, display the **Firmware Upgrade** screen as shown next.

**Figure 87** Firmware Upgrade


Firmware Upgrade
Maintenance
To upgrade the internal switch firmware, browse to the location of the binary (.BIN) file and click upgrade button.
File Path
Browse...
Upgrade

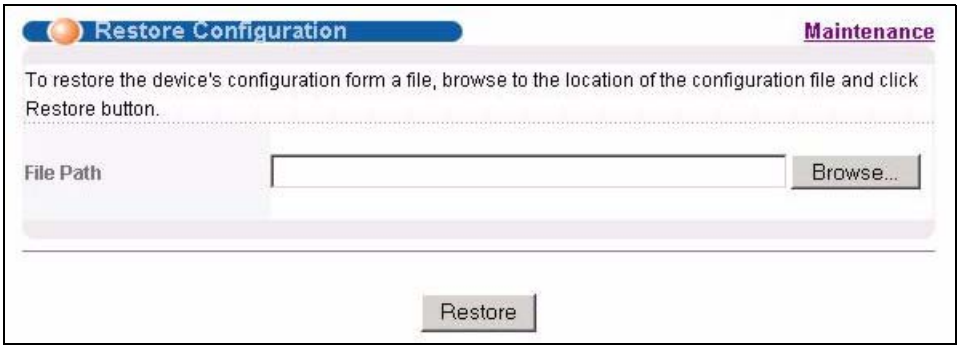
Type the path and file name of the firmware file you wish to upload to the switch in the **File Path** text box or click **Browse** to locate it. After you have specified the file, click **Upgrade**.

After the firmware upgrade process is complete, see the **System Info** screen to verify your current firmware version number.

## 26.6 Restore a Configuration File

Restore a previously saved configuration from your computer to the switch using the **Restore Configuration** screen.

**Figure 88** Restore Configuration


Restore Configuration
Maintenance
To restore the device's configuration form a file, browse to the location of the configuration file and click Restore button.
File Path
Browse...
Restore

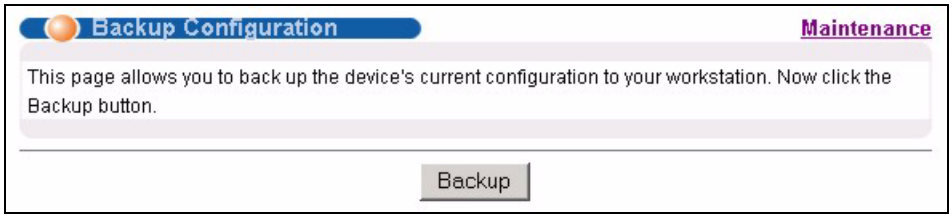
Type the path and file name of the configuration file you wish to restore in the **File Path** text box or click **Browse** to display the **Choose File** screen (below) from which you can locate it. After you have specified the file, click **Restore**. "config" is the name of the configuration file on the switch, so your backup configuration file is automatically renamed when you restore using this screen.

## 26.7 Backup a Configuration File

Backing up your switch configurations allows you to create various "snap shots" of your device from which you may restore at a later date.

Back up your current switch configuration to a computer using the **Backup Configuration** screen.

**Figure 89** Backup Configuration


Backup Configuration
Maintenance
This page allows you to back up the device's current configuration to your workstation. Now click the Backup button.
Backup

Follow the steps below to back up the current switch configuration to your computer in this screen.

1. Click **Backup**.
2. Click **Save** to display the **Save As** screen.
3. Choose a location to save the file on your computer from the **Save in** drop-down list box and type a descriptive name for it in the **File name** list box. Click **Save** to save the configuration file to your computer.

## 26.8 FTP Command Line

This section shows some examples of uploading to or downloading files from the switch using FTP commands. First, understand the filename conventions.

### 26.8.1 Filename Conventions

The configuration file (also known as the romfile or ROM) contains the factory default settings in the screens such as password, switch setup, IP Setup, etc.. Once you have customized the switch's settings, they can be saved back to your computer under a filename of your choosing.

ZyNOS (ZyXEL Network Operating System sometimes referred to as the "ras" file) is the system firmware and has a "bin" filename extension.

**Table 62** Filename Conventions

| FILE TYPE | INTERNAL NAME | EXTERNAL NAME | DESCRIPTION |
|---|---|---|---|
| Configuration File | config | | This is the configuration filename on the switch. Uploading the config file replaces the specified configuration file system, including your switch configurations, system-related data (including the default password), the error log and the trace log. |
| Firmware | ras | *.bin | This is the generic name for the ZyNOS firmware on the switch. |

#### 26.8.1.1 Example FTP Commands

```
ftp> put firmware.bin ras
```

This is a sample FTP session showing the transfer of the computer file "firmware.bin" to the switch.

```
ftp> get config config.cfg
```

This is a sample FTP session saving the current configuration to a file called "config.cfg" on your computer.

If your (T)FTP client does not allow you to have a destination filename different than the source, you will need to rename them as the switch only recognizes "config" and "ras". Be sure you keep unaltered copies of both files for later use.

**Note:** Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your device.

### 26.8.2 FTP Command Line Procedure

1. Launch the FTP client on your computer.
2. Enter `open`, followed by a space and the IP address of your switch.
3. Press [ENTER] when prompted for a username.
4. Enter your password as requested (the default is "1234").
5. Enter `bin` to set transfer mode to binary.
6. Use `put` to transfer files from the computer to the switch, for example, `put firmware.bin ras` transfers the firmware on your computer (firmware.bin) to the switch and renames it to "ras". Similarly, `put config.cfg config` transfers the configuration file on your computer (config.cfg) to the switch and renames it to "config". Likewise `get config config.cfg` transfers the configuration file on the switch to your computer and renames it to "config.cfg". See Table 62 on page 195 for more information on filename conventions.
7. Enter `quit` to exit the ftp prompt.

### 26.8.3 GUI-based FTP Clients

The following table describes some of the commands that you may see in GUI-based FTP clients.

General Commands for GUI-based FTP Clients

| COMMAND | DESCRIPTION |
|---|---|
| Host Address | Enter the address of the host server. |
| Login Type | Anonymous.<br>This is when a user I.D. and password is automatically supplied to the server for anonymous access. Anonymous logins will work only if your ISP or service administrator has enabled this option.<br>Normal.<br>The server requires a unique User ID and Password to login. |
| Transfer Type | Transfer files in either ASCII (plain text format) or in binary mode. Configuration and firmware files should be transferred in binary mode. |
| Initial Remote Directory | Specify the default remote directory (path). |
| Initial Local Directory | Specify the default local directory (path). |

### 26.8.4 FTP Restrictions

FTP will not work when:

- FTP service is disabled in the **Service Access Control** screen.
- The IP address(es) in the **Remote Management** screen does not match the client IP address. If it does not match, the switch will disconnect the Telnet session immediately.

# CHAPTER 27
# Access Control

This chapter describes how to control access to the switch.

## 27.1 Access Control Overview

A console port and FTP are allowed one session each, Telnet and SSH share four sessions, up to five Web sessions (five different usernames and passwords) and/or limitless SNMP access control sessions are allowed.

**Table 63** Access Control Overview

| Console Port | SSH | Telnet | FTP | Web | SNMP |
|---|---|---|---|---|---|
| One session | Share up to four sessions | | One session | Up to five accounts | No limit |

A console port access control session and Telnet access control session cannot coexist when multi-login is disabled. See Section 34.11.2 on page 241 for more information on disabling multi-login.

## 27.2 The Access Control Main Screen

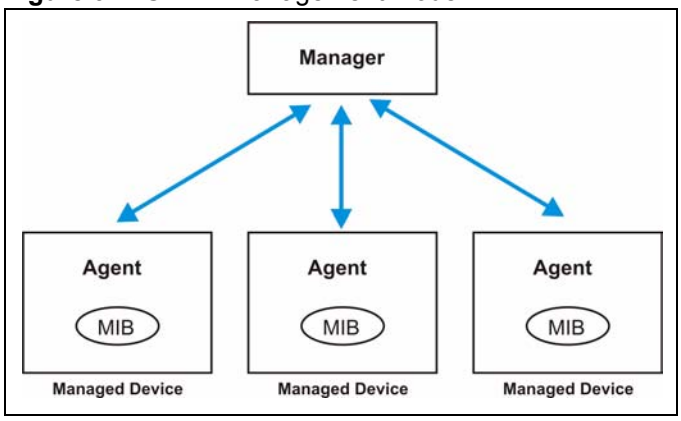
Click **Management**, **Access Control** in the navigation panel to display the main screen as shown.

**Figure 90** Access Control

## 27.3 About SNMP

Simple Network Management Protocol (SNMP) is an application layer protocol used to manage and monitor TCP/IP-based devices. SNMP is used to exchange management information between the network management system (NMS) and a network element (NE). A manager station can manage and monitor the switch through the network via SNMP version one (SNMPv1) and/or SNMP version 2c. The next figure illustrates an SNMP management operation. SNMP is only available if TCP/IP is configured.

**Figure 91** SNMP Management Model




An SNMP managed network consists of two main components: agents and a manager.

An agent is a management software module that resides in a managed switch (the switch). An agent translates the local management information from the managed switch into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a switch. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

**Table 64** SNMP Commands

| COMMAND | DESCRIPTION |
|---|---|
| Get | Allows the manager to retrieve an object variable from the agent. |
| GetNext | Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations. |

**Table 64** SNMP Commands

| COMMAND | DESCRIPTION |
|---|---|
| Set | Allows the manager to set values for object variables within an agent. |
| Trap | Used by the agent to inform the manager of some events. |

## 27.3.1 Supported MIBs

MIBs let administrators collect statistics and monitor status and performance.

The switch supports the following MIBs:

- SNMP MIB II (RFC 1213)
- RFC 1157 SNMP v1
- RFC 1493 Bridge MIBs
- RFC 1643 Ethernet MIBs
- RFC 1155 SMI
- RFC 2674 SNMPv2, SNMPv2c
- RFC 1757 RMON
- SNMPv2, SNMPv2c or later version, compliant with RFC 2011 SNMPv2 MIB for IP, RFC 2012 SNMPv2 MIB for TCP, RFC 2013 SNMPv2 MIB for UDP

## 27.3.2 SNMP Traps

The switch sends traps to an SNMP manager when an event occurs. SNMP traps supported are outlined in the following table.

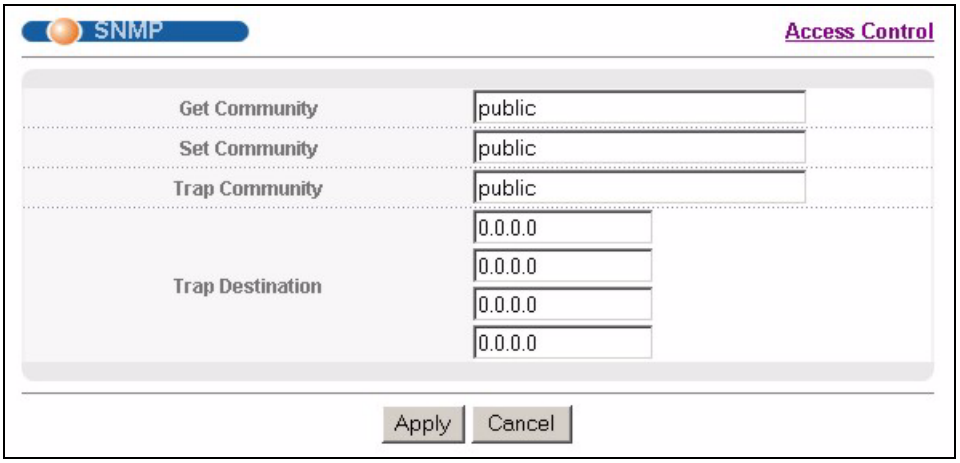
**Table 65** SNMP Traps

| OBJECT LABEL | OBJECT ID | DESCRIPTION |
|---|---|---|
| SNMPv2 Traps | | |
| Cold Start | 1.3.6.1.6.3.1.1.5.1 | This trap is sent when the switch is turned on. |
| WarmStart | 1.3.6.1.6.3.1.1.5.2 | This trap is sent when the switch restarts. |
| linkDown | 1.3.6.1.6.3.1.1.5.3 | This trap is sent when the Ethernet link is down. |
| linkUp | 1.3.6.1.6.3.1.1.5.4 | This trap is sent when the Ethernet link is up. |
| authenticationFailure | 1.3.6.1.6.3.1.1.5.5 | This trap is sent when an SNMP request comes from non-authenticated hosts. |
| RFC 1493 Traps | | |
| newRoot | 1.3.6.1.2.1.17.0.1 | This trap is sent when the STP topology changes. |
| topology change | 1.3.6.1.2.1.17.0.2 | This trap is sent when the STP root switch changes. |

## 27.3.3 Configuring SNMP

From the **Access Control** screen, display the **SNMP** screen. You can click **Access Control** to go back to the **Access Control** screen.

**Figure 92** Access Control: SNMP




The following table describes the labels in this screen.

**Table 66** Access Control: SNMP

| LABEL | DESCRIPTION |
|---|---|
| Get Community | Enter the get community, which is the password for the incoming Get- and GetNext-requests from the management station. |
| Set Community | Enter the set community, which is the password for incoming Set- requests from the management station. |
| Trap Community | Enter the trap community, which is the password sent with each trap to the SNMP manager. |
| Trap Destination | Enter the IP addresses of up to four stations to send your SNMP traps to. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 27.3.4 Setting Up Login Accounts

Up to five people (one administrator and four non-administrators) may access the switch via web configurator at any one time.

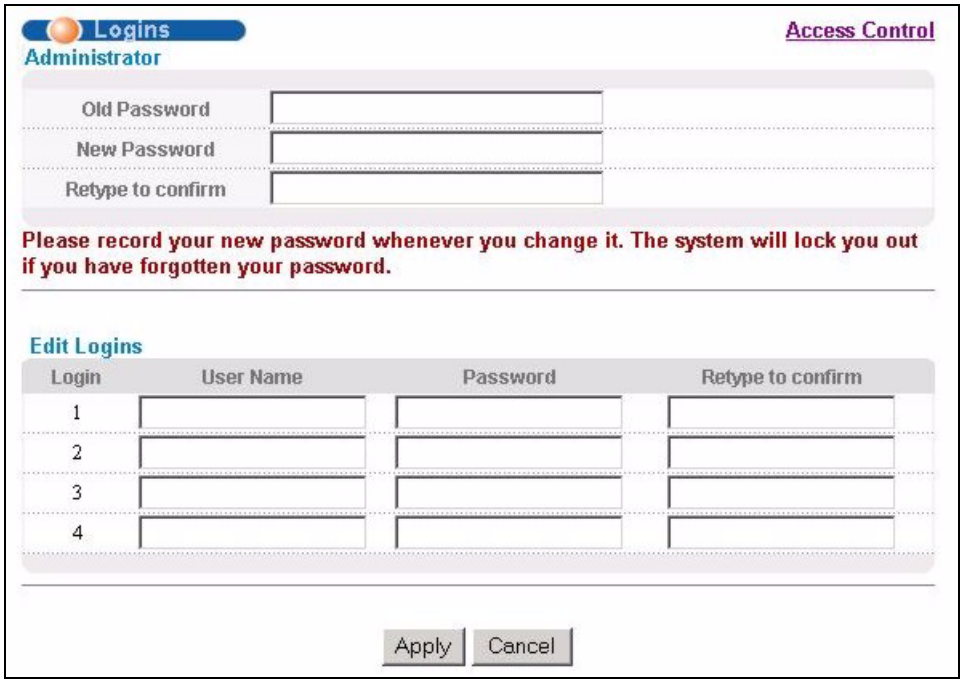
- An administrator is someone who can both view and configure switch changes. The username for the Administrator is always **admin**. The default administrator password is **1234**.

**Note:** It is highly recommended that you change the default administrator password (**1234**).

- A non-administrator (username is something other than **admin**) is someone who can view but not configure switch settings.

Click **Access Control** from the navigation panel and then click **Logins** from this screen.

**Figure 93** Access Control: Logins




The following table describes the labels in this screen.

**Table 67** Access Control: Logins

| LABEL | DESCRIPTION |
|---|---|
| Administrator<br>This is the default administrator account with the "admin" user name. You cannot change the default administrator user name. Only the administrator has read/write access. | |
| Old Password | Type the existing system password (**1234** is the default password when shipped). |
| New Password | Enter your new system password. |
| Retype to confirm | Retype your new system password for confirmation |
| Edit Logins<br>You may configure passwords for up to four users. These users have read-only access. You can give users higher privileges via the CLI. For more information on assigning privileges see Chapter 34 on page 233. | |
| User Name | Set a user name (up to 32 ASCII characters long). |
| Password | Enter your new system password. |
| Retype to confirm | Retype your new system password for confirmation |

**Table 67** Access Control: Logins (continued)

| LABEL | DESCRIPTION |
|---|---|
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 27.4 SSH Overview

Unlike Telnet or FTP, which transmit data in clear text, SSH (Secure Shell) is a secure communication protocol that combines authentication and data encryption to provide secure encrypted communication

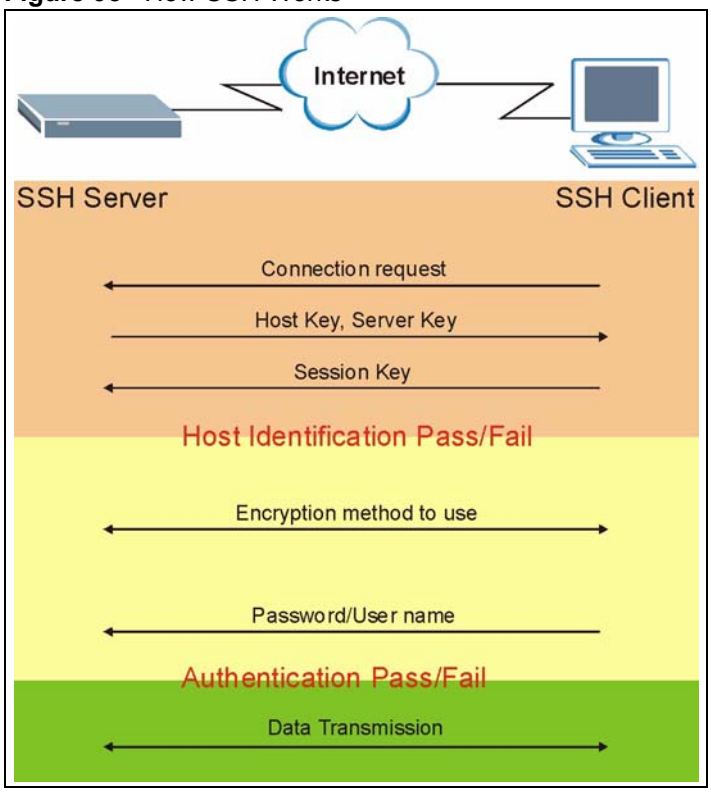
between two hosts over an unsecured network.

**Figure 94** SSH Communication Example

## 27.5 How SSH works

The following table summarizes how a secure connection is established between two remote hosts.

**Figure 95** How SSH Works




**1** Host Identification

The SSH client sends a connection request to the SSH server. The server identifies itself with a host key. The client encrypts a randomly generated session key with the host key and server key and sends the result back to the server.

The client automatically saves any new server public keys. In subsequent connections, the server public key is checked against the saved version on the client computer.

**2** Encryption Method

Once the identification is verified, both the client and server must agree on the type of encryption method to use.

**3** Authentication and Data Transmission

After the identification is verified and data encryption activated, a secure tunnel is established between the client and the server. The client then sends its authentication information (user name and password) to the server to log in to the server.

## 27.6 SSH Implementation on the Switch

Your switch supports SSH version 2 using RSA authentication and three encryption methods (DES, 3DES and Blowfish). The SSH server is implemented on the switch for remote management and file transfer on port 22. Only one SSH connection is allowed at a time.

### 27.6.1 Requirements for Using SSH

You must install an SSH client program on a client computer (Windows or Linux operating system) that is used to connect to the switch over SSH.

## 27.7 Introduction to HTTPS

HTTPS (HyperText Transfer Protocol over Secure Socket Layer, or HTTP over SSL) is a web protocol that encrypts and decrypts web pages. Secure Socket Layer (SSL) is an application-level protocol that enables secure transactions of data by ensuring confidentiality (an unauthorized party cannot read the transferred data), authentication (one party can identify the other party) and data integrity (you know if data has been changed).

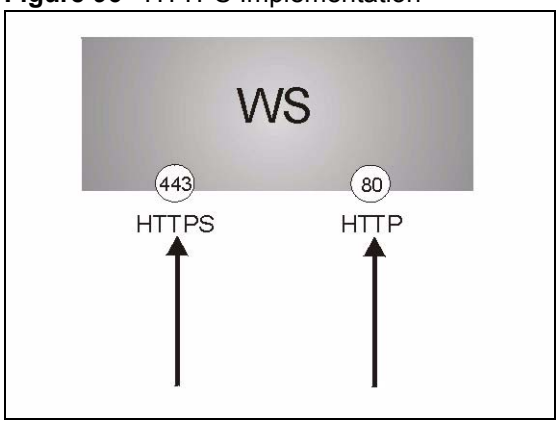
It relies upon certificates, public keys, and private keys.

HTTPS on the switch is used so that you may securely access the switch using the web configurator. The SSL protocol specifies that the SSL server (the switch) must always authenticate itself to the SSL client (the computer which requests the HTTPS connection with the switch), whereas the SSL client only should authenticate itself when the SSL server requires it to do so. Authenticating client certificates is optional and if selected means the SSL-client must send the switch a certificate. You must apply for a certificate for the browser from a CA that is a trusted CA on the switch.

Please refer to the following figure.

1. HTTPS connection requests from an SSL-aware web browser go to port 443 (by default) on the switch's WS (web server).
2. HTTP connection requests from a web browser go to port 80 (by default) on the switch's WS (web server).

**Figure 96** HTTPS Implementation




**Note:** If you disable **HTTP** in the **Service Access Control** screen, then the switch blocks all HTTP connection attempts.

## 27.8 HTTPS Example

If you haven't changed the default HTTPS port on the switch, then in your browser enter "https://switch IP Address/" as the web site address where "switch IP Address" is the IP address or domain name of the switch you wish to access.

### 27.8.1 Internet Explorer Warning Messages

When you attempt to access the switch HTTPS server, a Windows dialog box pops up asking if you trust the server certificate. Click **View Certificate** if you want to verify that the certificate is from the switch.

You see the following **Security Alert** screen in Internet Explorer. Select **Yes** to proceed to the web configurator login screen; if you select **No**, then web configurator access is blocked.

**Figure 97** Security Alert Dialog Box (Internet Explorer)

Security Alert
Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.
The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.
The security certificate date is valid.
The name on the security certificate is invalid or does not match the name of the site
Do you want to proceed?
Yes
No
View Certificate

### 27.8.2 Netscape Navigator Warning Messages

When you attempt to access the switch HTTPS server, a **Website Certified by an Unknown Authority** screen pops up asking if you trust the server certificate. Click **Examine Certificate** if you want to verify that the certificate is from the switch.

If **Accept this certificate temporarily for this session** is selected, then click **OK** to continue in Netscape.

Select **Accept this certificate permanently** to import the switch's certificate into the SSL client.

**Figure 98** Security Certificate 1 (Netscape)

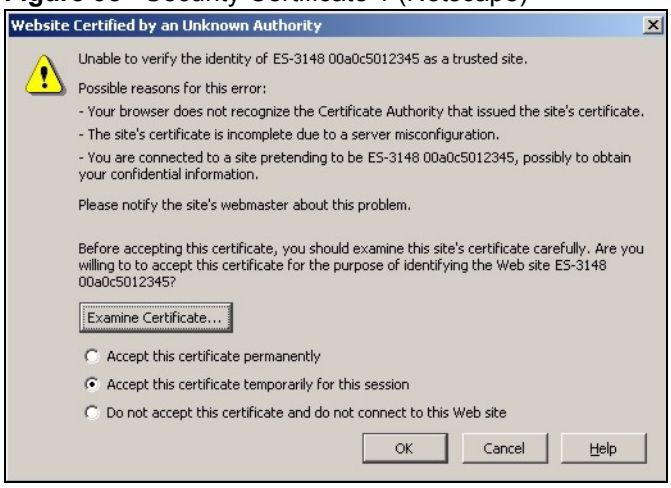

Website Certified by an Unknown Authority
Unable to verify the identity of ES-3148 00a0c5012345 as a trusted site.
Possible reasons for this error:
- Your browser does not recognize the Certificate Authority that issued the site's certificate.
- The site's certificate is incomplete due to a server misconfiguration.
- You are connected to a site pretending to be ES-3148 00a0c5012345, possibly to obtain your confidential information.
Please notify the site's webmaster about this problem.
Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the Web site ES-3148 00a0c5012345?
Examine Certificate...
Accept this certificate permanently
Accept this certificate temporarily for this session
Do not accept this certificate and do not connect to this Web site
OK
Cancel
Help

**Figure 99** Security Certificate 2 (Netscape)

Security Error: Domain Name Mismatch
You have attempted to establish a connection with "192.168.1.1". However, the security certificate presented belongs to "ES-3148 00a0c5012345". It is possible, though unlikely, that someone may be trying to intercept your communication with this web site.
If you suspect the certificate shown does not belong to "192.168.1.1", please cancel the connection and notify the site administrator.
View Certificate
OK
Cancel
Help

## 27.8.3 The Main Screen

After you accept the certificate and enter the login username and password, the switch main screen appears. The lock displayed in the bottom right of the browser status bar denotes a secure connection.

**Figure 100** Login Screen (Internet Explorer)

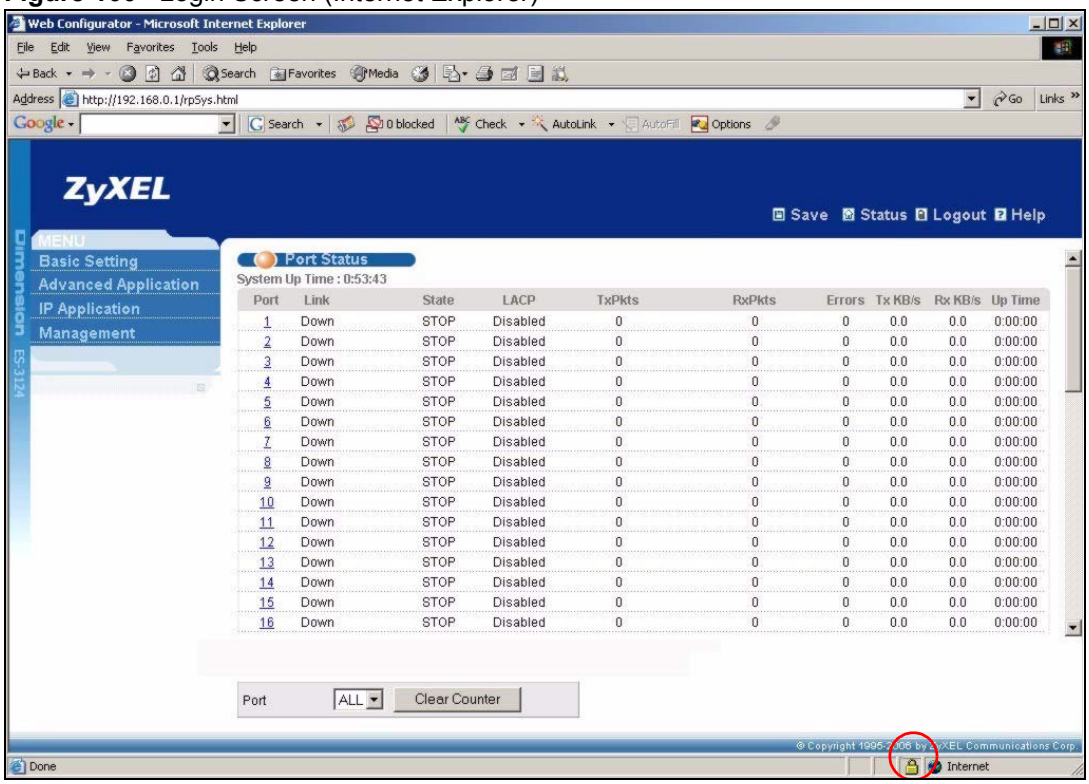
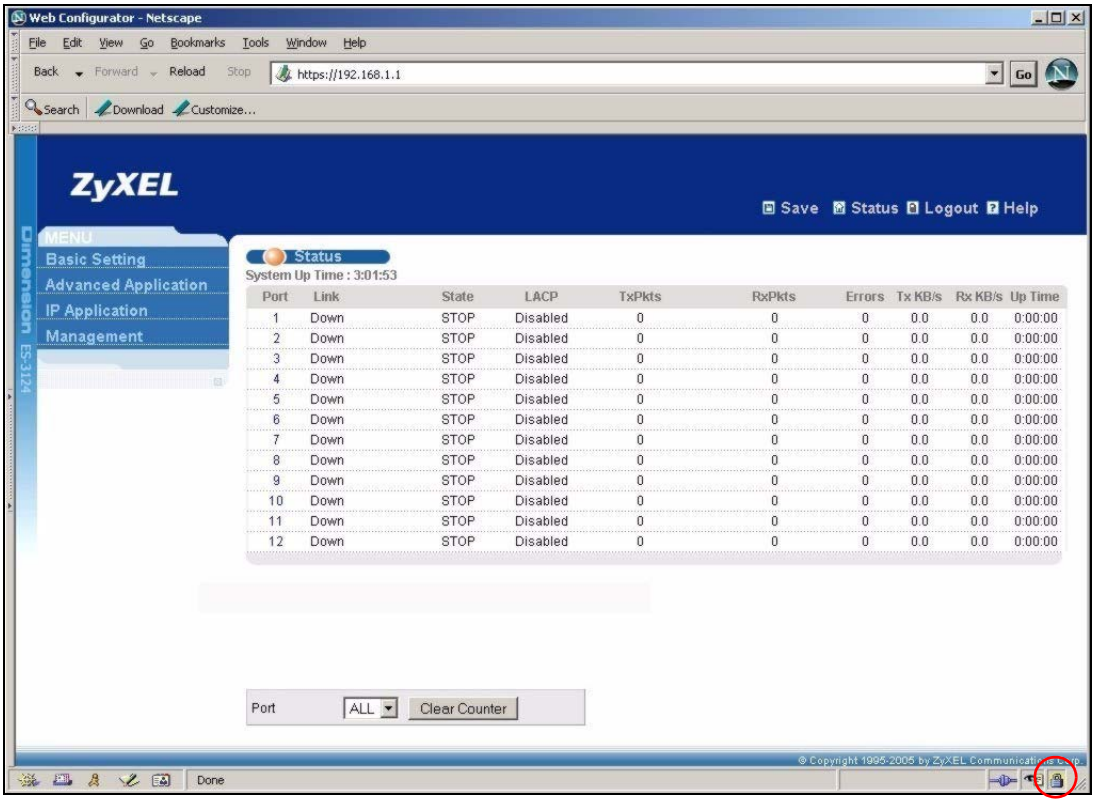


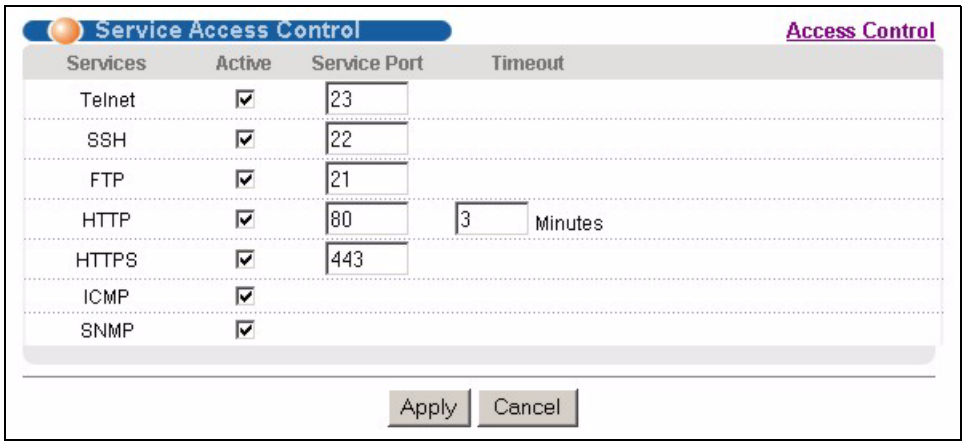
**Figure 101** Login Screen (Netscape)


Web Configurator - Netscape
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
https://192.168.1.1
Go
Search Download Customize...
ZyXEL
Save Status Logout Help
MENU
Basic Setting
Advanced Application
IP Application
Management
Dimension ES-3124
Status
System Up Time : 3:01:53
Port Link State LACP TxPkts RxPkts Errors Tx KB/s Rx KB/s Up Time
1 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
2 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
3 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
4 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
5 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
6 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
7 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
8 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
9 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
10 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
11 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
12 Down STOP Disabled 0 0 0 0.0 0.0 0:00:00
Port ALL Clear Counter
© Copyright 1995-2005 by ZyXEL Communications Corp.
Done

## 27.9 Service Port Access Control

Service Access Control allows you to decide what services you may use to access the switch. You may also change the default service port and configure "trusted computer(s)" for each service in the **Remote Management** screen (discussed later). Click **Access Control** to go back to the main **Access Control** screen.

**Figure 102** Access Control: Service Access Control




The following table describes the fields in this screen.

**Table 68** Access Control: Service Access Control

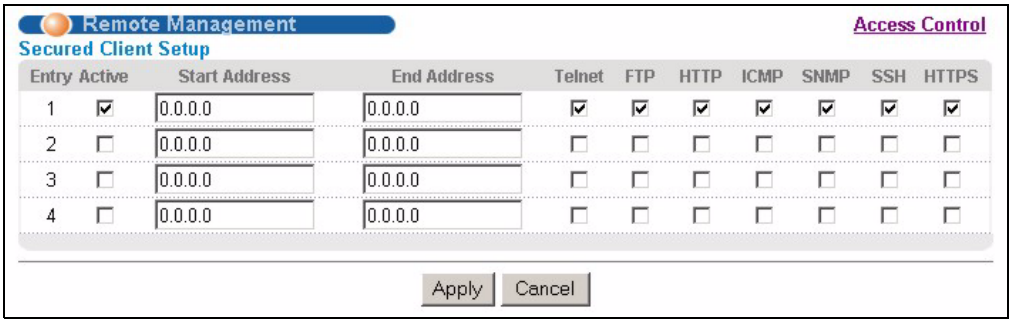
| LABEL | DESCRIPTION |
|---|---|
| Services | Services you may use to access the switch are listed here. |
| Active | Select this option for the corresponding services that you want to allow to access the switch. |
| Service Port | For Telnet, SSH, FTP, HTTP or HTTPS services, you may change the default service port by typing the new port number in the **Server Port** field. If you change the default port number then you will have to let people (who wish to use the service) know the new port number for that service. |
| Timeout | Type how many minutes a management session (via the web configurator) can be left idle before the session times out. After it times out you have to log in with your password again. Very long idle timeouts may have security risks. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 27.10 Remote Management

From the **Access Control** screen, display the **Remote Management** screen as shown next.

You can specify a group of one or more "trusted computers" from which an administrator may use a service to manage the switch. Click **Access Control** to return to the **Access Control** screen.

**Figure 103** Access Control: Remote Management




The following table describes the labels in this screen.

**Table 69** Access Control: Remote Management

| LABEL | DESCRIPTION |
|---|---|
| Entry | This is the client set index number. A "client set" is a group of one or more "trusted computers" from which an administrator may use a service to manage the switch. |
| Active | Select this check box to activate this secured client set. Clear the check box if you wish to temporarily disable the set without deleting it. |
| Start Address<br>End Address | Configure the IP address range of trusted computers from which you can manage this switch.<br>The switch checks if the client IP address of a computer requesting a service or protocol matches the range set here. The switch immediately disconnects the session if it does not match. |
| Telnet/FTP/ HTTP/ICMP/ SNMP/SSH/ HTTPS | Select services that may be used for managing the switch from the specified trusted computers. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

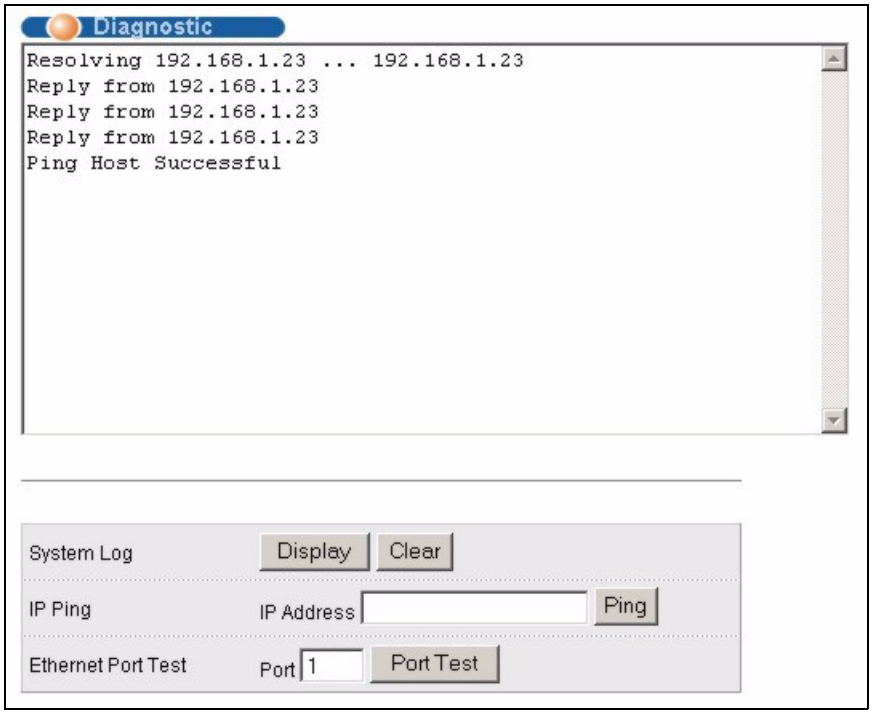
# CHAPTER 28
# Diagnostic

This chapter explains the **Diagnostic** screen.

## 28.1 Diagnostic

Click **Management**, **Diagnostic** in the navigation panel to open this screen. Use this screen to check system logs, ping IP addresses or perform port tests.

**Figure 104** Diagnostic




The following table describes the labels in this screen.

**Table 70** Diagnostic

| LABEL | DESCRIPTION |
|---|---|
| System Log | Click **Display** to display a log of events in the multi-line text box.<br>Click **Clear** to empty the text box and reset the syslog entry. |
| IP Ping | Type the IP address of a device that you want to ping in order to test a connection.<br>Click **Ping** to have the switch ping the IP address (in the field to the left). |
| Ethernet Port Test | Enter a port number and click **Port Test** to perform an internal loopback test. |

# CHAPTER 29
# Syslog

This chapter explains the syslog screens.

## 29.1 Syslog Overview

The syslog protocol allows devices to send event notification messages across an IP network to syslog servers that collect the event messages. A syslog-enabled device can generate a syslog message and send it to a syslog server.

Syslog is defined in RFC 3164. The RFC defines the packet format, content and system log related information of syslog messages. Each syslog message has a facility and severity level. The syslog facility identifies a file in the syslog server. Refer to the documentation of your syslog program for details. The following table describes the syslog severity levels.

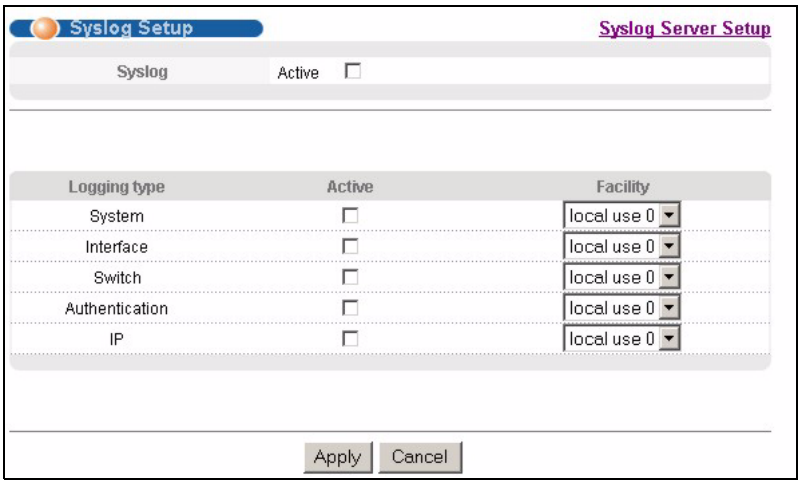
**Table 71** Syslog Severity Levels

| CODE | SEVERITY |
|---|---|
| 0 | Emergency: The system is unusable. |
| 1 | Alert: Action must be taken immediately. |
| 2 | Critical: The system condition is critical. |
| 3 | Error: There is an error condition on the system. |
| 4 | Warning: There is a warning condition on the system. |
| 5 | Notice: There is a normal but significant condition on the system. |
| 6 | Informational: The syslog contains an informational message. |
| 7 | Debug: The message is intended for debug-level purposes. |

## 29.2 Syslog Setup

Click **Management** and then **Syslog** in the navigation panel to display this screen. The syslog feature sends logs to an external syslog server. Use this screen to configure the device's system logging settings.

**Figure 105** Syslog




The following table describes the labels in this screen.

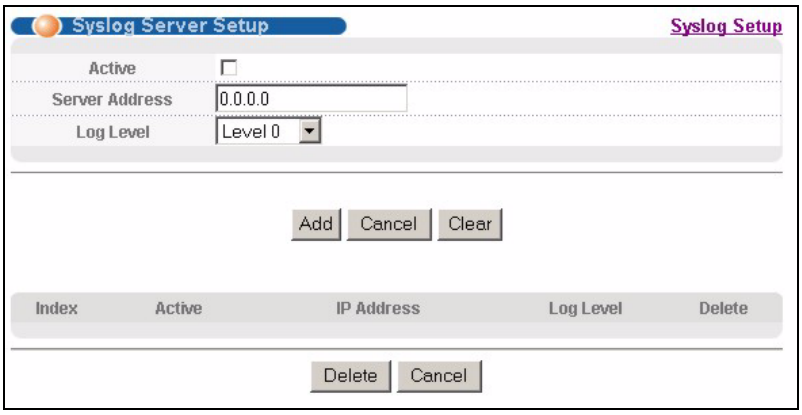
**Table 72** Syslog

| LABEL | DESCRIPTION |
|---|---|
| Syslog | Select **Active** to turn on syslog (system logging) and then configure the syslog setting |
| Logging Type | This column displays the names of the categories of logs that the device can generate. |
| Active | Select this option to set the device to generate logs for the corresponding category. |
| Facility | The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

## 29.3 Syslog Server Setup

Click **Management** and then **Syslog** in the navigation panel to display the **Syslog Setup** screen. Click the **Syslog Server Setup** link to open the following screen. Use this screen to configure a list of external syslog servers.

**Figure 106** Syslog: Server Setup




The following table describes the labels in this screen.

**Table 73** Syslog: Server Setup

| LABEL | DESCRIPTION |
|---|---|
| Active | Select this check box to have the device send logs to this syslog server. Clear the check box if you want to create a syslog server entry but not have the device send logs to it (you can edit the entry later). |
| Server Address | Enter the IP address of the syslog server. |
| Log Level | Select the severity level(s) of the logs that you want the device to send to this syslog server. The lower the number, the more critical the logs are. |
| Add | Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Clear | Click **Clear** to return the fields to the factory defaults. |
| Index | This is the index number of a syslog server entry. Click this number to edit the entry. |
| Active | This field displays **Yes** if the device is to send logs to the syslog server. **No** displays if the device is not to send logs to the syslog server. |
| IP Address | This field displays the IP address of the syslog server. |
| Log Level | This field displays the severity level of the logs that the device is to send to this syslog server. |
| Delete | Select an entry's **Delete** check box and click **Delete** to remove the entry. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 30
# Cluster Management

This chapter introduces cluster management.

## 30.1 Cluster Management Status Overview

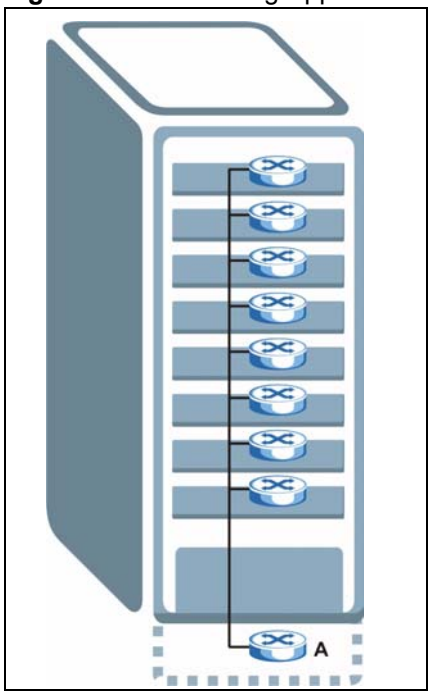
Cluster Management allows you to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another.

**Table 74** ZyXEL Clustering Management Specifications

| | |
|---|---|
| Maximum number of cluster members | 24 |
| Cluster Member Models | Must be compatible with ZyXEL cluster management implementation. |
| Cluster Manager | The switch through which you manage the cluster member switches. |
| Cluster Members | The switches being managed by the cluster manager switch. |

In the following example, switch **A** in the basement is the cluster manager and the other switches on the upper floors of the building are cluster members.

**Figure 107** Clustering Application Example

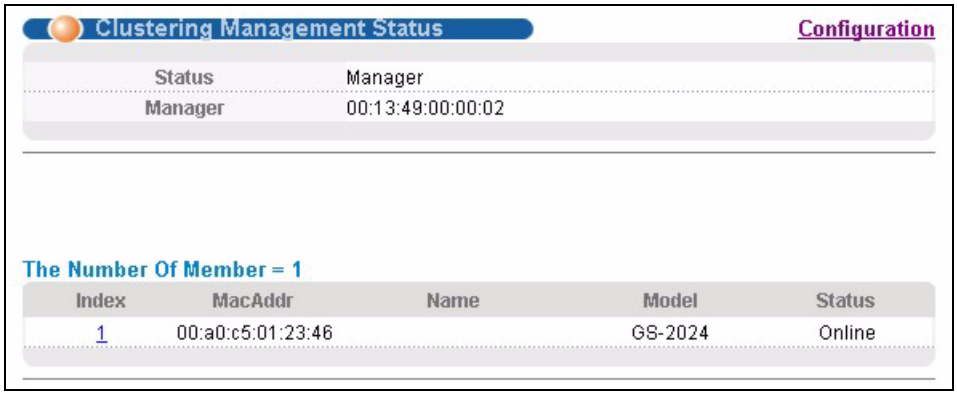



## 30.2 Cluster Management Status

Click **Management**, **Cluster Management** in the navigation panel to display the following screen.

**Note:** A cluster can only have one manager.

**Figure 108** Cluster Management: Status




The following table describes the labels in this screen.

**Table 75** Cluster Management: Status

| LABEL | DESCRIPTION |
|---|---|
| Status | This field displays the role of this switch within the cluster.<br>**Manager**<br>**Member** (you see this if you access this screen in the cluster member switch directly and not via the cluster manager)<br>**None** (neither a manager nor a member of a cluster) |
| Manager | This field displays the cluster manager switch's hardware MAC address. |
| The Number of Member | This field displays the number of switches that make up this cluster. The following fields describe the cluster member switches. |
| Index | You can manage cluster member switches via the cluster manager switch. Each number in the **Index** column is a hyperlink leading to the cluster member switch's web configurator (see Figure 109 on page 222). |
| MacAddr | This is the cluster member switch's hardware MAC address. |
| Name | This is the cluster member switch's **System Name**. |
| Model | This field displays the model name. |
| Status | This field displays:<br>**Online** (the cluster member switch is accessible)<br>**Error** (for example the cluster member switch password was changed or the switch was set as the manager and so left the member list, etc.)<br>**Offline** (the switch is disconnected - **Offline** shows approximately 1.5 minutes after the link between cluster member and manager goes down) |

## 30.2.1 Cluster Member Switch Management

Go to the **Clustering Management Status** screen of the cluster manager switch and then select an **Index** hyperlink from the list of members to go to that cluster member switch's web configurator home page. This cluster member web configurator home page and the home page that you'd see if you accessed it directly are different.

**Figure 109** Cluster Management: Cluster Member Web Configurator Screen

### 30.2.1.1 Uploading Firmware to a Cluster Member Switch

You can use FTP to upload firmware to a cluster member switch through the cluster manager switch as shown in the following example.

**Figure 110** Example: Uploading Firmware to a Cluster Member Switch

```
C:\>ftp 192.168.1.1
Connected to 192.168.1.1.
220 ES-3124 FTP version 1.0 ready at Thu Jan  1 00:58:46 1970
User (192.168.0.1:(none)): admin
331 Enter PASS command
Password:
230 Logged in
ftp> ls
200 Port command okay
150 Opening data connection for LIST
--w--w--w-   1 owner    group         3042210 Jul 01 12:00 ras
-rw-rw-rw-   1 owner    group          393216 Jul 01 12:00 config
--w--w--w-   1 owner    group               0 Jul 01 12:00 fw-00-a0-c5-01-23-46
-rw-rw-rw-   1 owner    group               0 Jul 01 12:00 config-00-a0-c5-01-23-46
226 File sent OK
ftp: 297 bytes received in 0.00Seconds 297000.00Kbytes/sec.
ftp> bin
200 Type I OK
ftp> put 370lt0.bin fw-00-a0-c5-01-23-46
200 Port command okay
150 Opening data connection for STOR fw-00-a0-c5-01-23-46
226 File received OK
ftp: 262144 bytes sent in 0.63Seconds 415.44Kbytes/sec.
ftp>
```

The following table explains some of the FTP parameters.

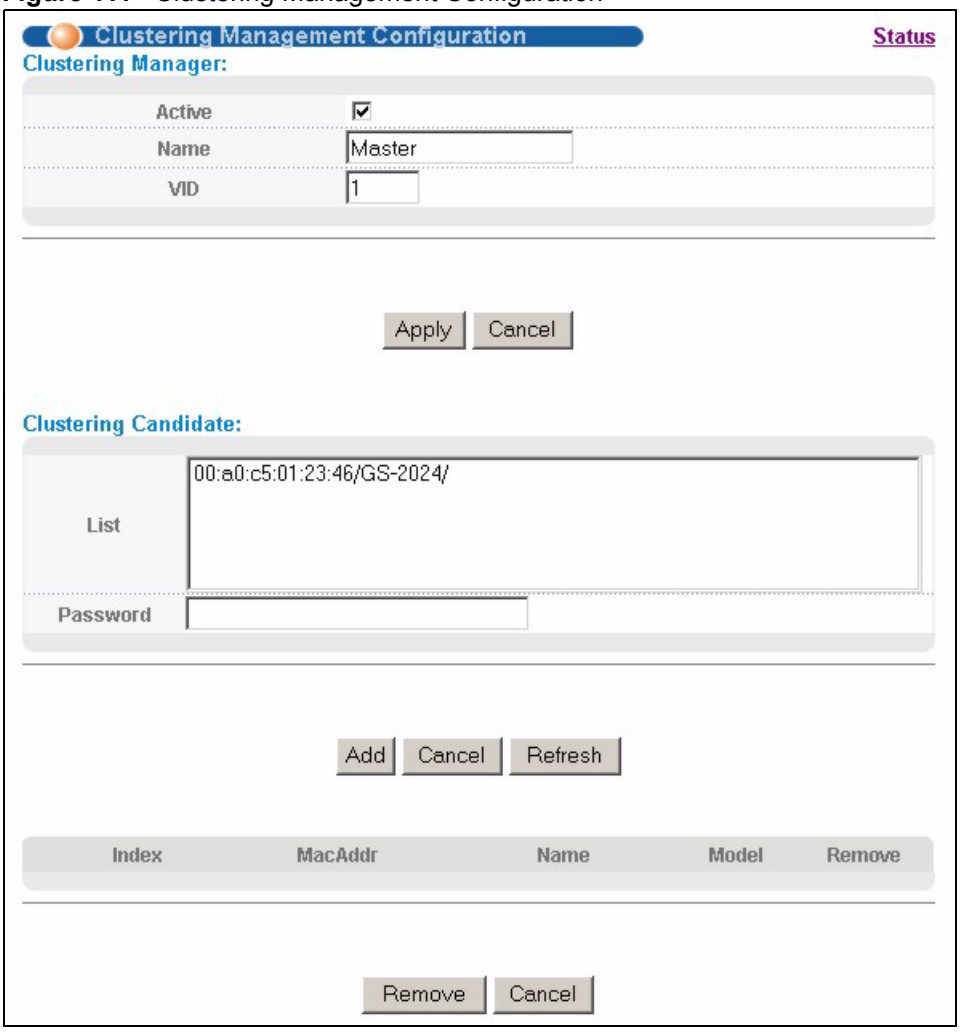
**Table 76** FTP Upload to Cluster Member Example

| FTP PARAMETER | DESCRIPTION |
|---|---|
| `User` | Enter "admin". |
| `Password` | The web configurator password default is 1234. |
| `ls` | Enter this command to list the name of cluster member switch's firmware and configuration file. |
| `360lt0.bin` | This is the name of the firmware file you want to upload to the cluster member switch. |
| `fw-00-a0-c5-01-23-46` | This is the cluster member switch's firmware name as seen in the cluster manager switch. |
| `config-00-a0-c5-01-23-46` | This is the cluster member switch's configuration file name as seen in the cluster manager switch. |

# 30.3 Clustering Management Configuration

Use this screen to configure clustering management. Click **Configuration** from the **Cluster Management** screen to display the next screen.

**Figure 111** Clustering Management Configuration




The following table describes the labels in this screen.

**Table 77** Clustering Management Configuration

| LABEL | DESCRIPTION |
|---|---|
| Clustering Manager | |
| Active | Select **Active** to have this switch become the cluster manager switch. A cluster can only have one manager. Other (directly connected) switches that are set to be cluster managers will not be visible in the **Clustering Candidates** list. If a switch that was previously a cluster member is later set to become a cluster manager, then its **Status** is displayed as **Error** in the **Cluster Management Status** screen and a warning icon ( ⚠ ) appears in the member summary list below. |
| Name | Type a name to identify the **Clustering Manager.** You may use up to 32 printable characters (spaces are allowed). |
| VID | This is the VLAN ID and is only applicable if the switch is set to **802.1Q** VLAN. All switches must be directly connected and in the same VLAN group to belong to the same cluster. Switches that are not in the same VLAN group are not visible in the **Clustering Candidates** list. This field is ignored if the **Clustering Manager** is using **Port-based** VLAN. |

**Table 77** Clustering Management Configuration (continued)

| LABEL | DESCRIPTION |
|---|---|
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |
| Clustering Candidate | The following fields relate to the switches that are potential cluster members. |
| List | A list of suitable candidates found by auto-discovery is shown here. The switches must be directly connected. Directly connected switches that are set to be cluster managers will not be visible in the **Clustering Candidate** list. Switches that are not in the same management VLAN group will not be visible in the **Clustering Candidate** list. |
| Password | Each cluster member's password is its web configurator password. Select a member in the **Clustering Candidate** list and then enter its web configurator password. If that switch administrator changes the web configurator password afterwards, then it cannot be managed from the **Cluster Manager**. Its **Status** is displayed as **Error** in the **Cluster Management Status** screen and a warning icon ( ⚠ ) appears in the member summary list below.<br>If multiple devices have the same password then hold [SHIFT] and click those switches to select them. Then enter their common web configurator password. |
| Add | Click **Add** to save this part of the screen to the switch. |
| Cancel | Click **Cancel** to reset the fields. |
| Refresh | Click **Refresh** to perform auto-discovery again to list potential cluster members. |
| The next summary table shows the information for the clustering members configured. | |
| Index | This is the index number of a cluster member switch. |
| MacAddr | This is the cluster member switch's hardware MAC address. |
| Name | This is the cluster member switch's **System Name**. |
| Model | This is the cluster member switch's model name. |
| Remove | Select this checkbox and then click the **Remove** button to remove a cluster member switch from the cluster. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 31
# MAC Table

This chapter introduces the **MAC Table** screen.

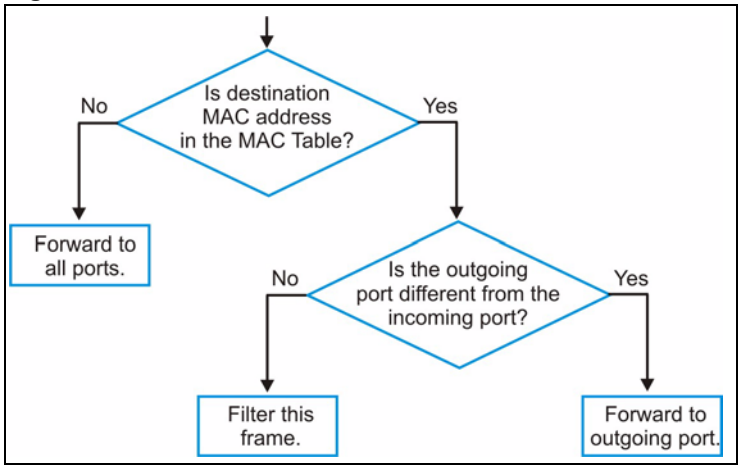
## 31.1 MAC Table Overview

The **MAC Table** screen (a MAC table is also known as a filtering database) shows how frames are forwarded or filtered across the switch's ports. It shows what device MAC address, belonging to what VLAN group (if any) is forwarded to which port(s) and whether the MAC address is dynamic (learned by the switch) or static (manually entered in the **Static MAC Forwarding** screen).

The switch uses the MAC table to determine how to forward frames. See the following figure.

1. The switch examines a received frame and learns the port on which this source MAC address came.
2. The switch checks to see if the frame's destination MAC address matches a source MAC address already learned in the MAC table.
    - If the switch has already learned the port for this MAC address, then it forwards the frame to that port.
    - If the switch has not already learned the port for this MAC address, then the frame is flooded to all ports. Too much port flooding leads to network congestion.
    - If the switch has already learned the port for this MAC address, but the destination port is the same as the port it came in on, then it filters the frame.

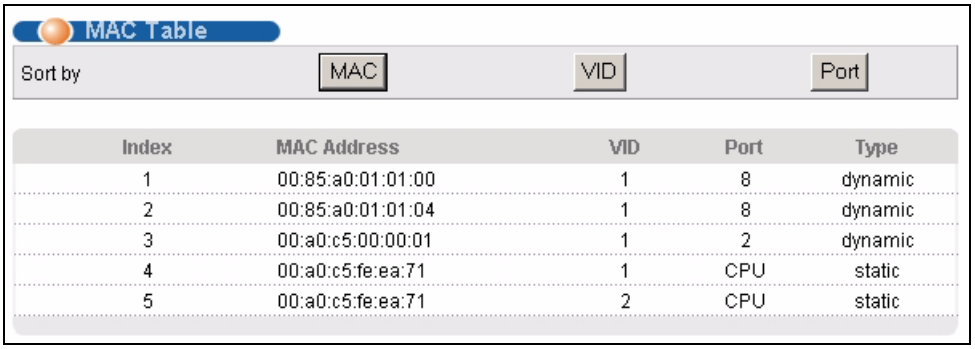
**Figure 112** MAC Table Flowchart



## 31.2 Viewing the MAC Table

Click **Management**, **MAC Table** in the navigation panel to display the following screen.

**Figure 113** MAC Table




The following table describes the labels in this screen.

**Table 78** MAC Table

| LABEL | DESCRIPTION |
|---|---|
| Sort by | Click one of the following buttons to display and arrange the data according to that button type. The information is then displayed in the summary table below. |
| MAC | Click this button to display and arrange the data according to MAC address. |
| VID | Click this button to display and arrange the data according to VLAN group. |
| Port | Click this button to display and arrange the data according to port number. |
| Index | This is the incoming frame index number. |
| MAC Address | This is the MAC address of the device from which this incoming frame came. |
| VID | This is the VLAN group to which this frame belongs. |
| Port | This is the port from which the above MAC address was learned. |
| Type | This shows whether the MAC address is **dynamic** (learned by the switch) or **static** (manually entered in the **Static MAC Forwarding** screen). |

# CHAPTER 32
# ARP Table

This chapter introduces ARP Table.

## 32.1 ARP Table Overview

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network.

An IP (version 4) address is 32 bits long. In an Ethernet LAN, MAC addresses are 48 bits long. The ARP Table maintains an association between each MAC address and its corresponding IP address.

### 32.1.1 How ARP Works

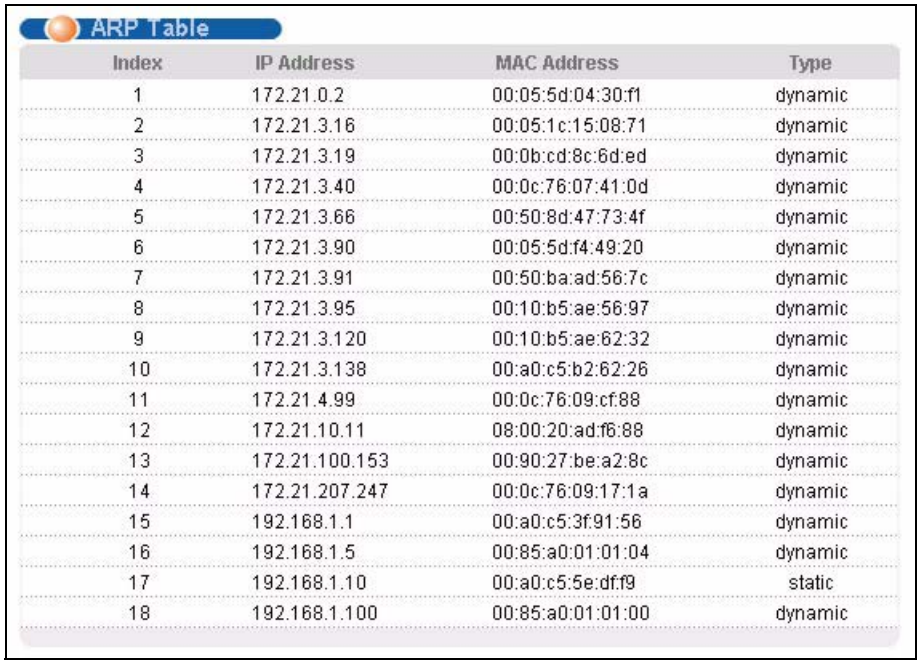
When an incoming packet destined for a host device on a local area network arrives at the switch, the switch's ARP program looks in the ARP Table and, if it finds the address, sends it to the device.

If no entry is found for the IP address, ARP broadcasts the request to all the devices on the LAN. The switch fills in its own MAC and IP address in the sender address fields, and puts the known IP address of the target in the target IP address field. In addition, the switch puts all ones in the target MAC field (FF.FF.FF.FF.FF.FF is the Ethernet broadcast address). The replying device (which is either the IP address of the device being sought or the router that knows the way) replaces the broadcast address with the target's MAC address, swaps the sender and target pairs, and unicasts the answer directly back to the requesting machine. ARP updates the ARP Table for future reference and then sends the packet to the MAC address that replied.

## 32.2 Viewing the ARP Table

Click **Management**, **ARP Table** in the navigation panel to open the following screen. Use the ARP table to view IP-to-MAC address mapping(s).

**Figure 114** ARP Table



ARP Table

| Index | IP Address | MAC Address | Type |
|---|---|---|---|
| 1 | 172.21.0.2 | 00:05:5d:04:30:f1 | dynamic |
| 2 | 172.21.3.16 | 00:05:1c:15:08:71 | dynamic |
| 3 | 172.21.3.19 | 00:0b:cd:8c:6d:ed | dynamic |
| 4 | 172.21.3.40 | 00:0c:76:07:41:0d | dynamic |
| 5 | 172.21.3.66 | 00:50:8d:47:73:4f | dynamic |
| 6 | 172.21.3.90 | 00:05:5d:f4:49:20 | dynamic |
| 7 | 172.21.3.91 | 00:50:ba:ad:56:7c | dynamic |
| 8 | 172.21.3.95 | 00:10:b5:ae:56:97 | dynamic |
| 9 | 172.21.3.120 | 00:10:b5:ae:62:32 | dynamic |
| 10 | 172.21.3.138 | 00:a0:c5:b2:62:26 | dynamic |
| 11 | 172.21.4.99 | 00:0c:76:09:cf:88 | dynamic |
| 12 | 172.21.10.11 | 08:00:20:ad:f6:88 | dynamic |
| 13 | 172.21.100.153 | 00:90:27:be:a2:8c | dynamic |
| 14 | 172.21.207.247 | 00:0c:76:09:17:1a | dynamic |
| 15 | 192.168.1.1 | 00:a0:c5:3f:91:56 | dynamic |
| 16 | 192.168.1.5 | 00:85:a0:01:01:04 | dynamic |
| 17 | 192.168.1.10 | 00:a0:c5:5e:df:f9 | static |
| 18 | 192.168.1.100 | 00:85:a0:01:01:00 | dynamic |

The following table describes the labels in this screen.

**Table 79** ARP Table

| LABEL | DESCRIPTION |
|---|---|
| Index | This is the ARP Table entry number. |
| IP Address | This is the learned IP address of a device connected to a switch port with corresponding MAC address below. |
| MAC Address | This is the MAC address of the device with corresponding IP address above. |
| Type | This shows whether the MAC address is dynamic (learned by the switch) or static (manually entered in the **Static MAC Forwarding** screen). |

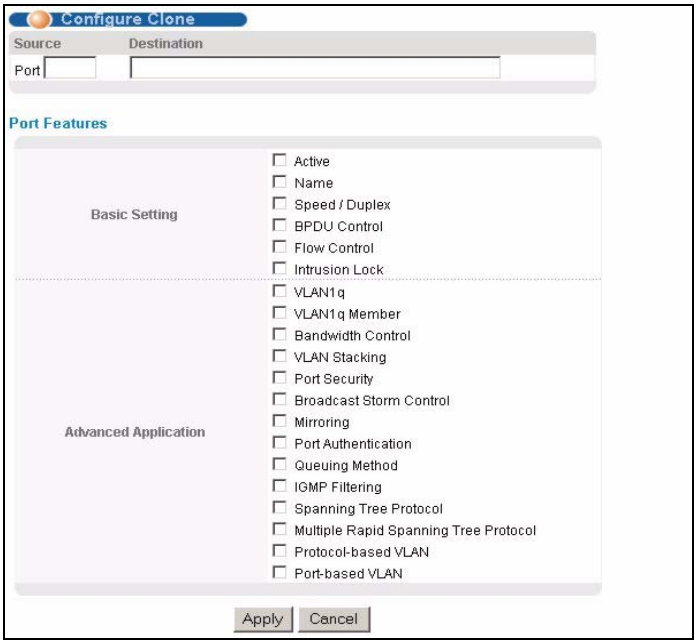
# CHAPTER 33
# Configure Clone

This chapter shows you how you can copy the settings of one port onto other ports.

## 33.1 Configure Clone

Cloning allows you to copy the basic and advanced settings from a source port to a destination port or ports. Click **Management**, **Configure Clone** to open the following screen.

**Figure 115** Configure Clone



The following table describes the labels in this screen.

**Table 80** Configure Clone

| LABEL | DESCRIPTION |
|---|---|
| Source/ Destination Port | Enter the source port under the **Source** label. This port's attributes are copied.<br>Enter the destination port or ports under the **Destination** label. These are the ports which are going to have the same attributes as the source port. You can enter individual ports seperated by a comma or a range of ports by using a dash.<br>Example:<br>• **2, 4, 6** indicates that ports 2, 4 and 6 are the destination ports.<br>• **2-6** indicates that ports 2 through 6 are the destination ports. |
| Basic Setting | Select which port settings (you configured in the **Basic Setting** menus) should be copied to the destination port(s). |
| Advanced Application | Select which port settings (you configured in the **Advanced Application** menus) should be copied to the destination ports. |
| Apply | Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring. |
| Cancel | Click **Cancel** to reset the fields. |

# CHAPTER 34
# Introducing Commands

This chapter introduces commands and gives a summary of commands available.

## 34.1 Overview

In addition to the web configurator, you can use commands to configure the switch. Use commands for advanced switch diagnosis and troubleshooting. If you have problems with your switch, customer support may request that you issue some of these commands to assist them in troubleshooting.

**Note:** See the web configurator parts of this User's Guide for background information on features configurable by the web configurator.

## 34.2 Accessing the CLI

You can use a direct console connection or Telnet to access the command interpreter on the switch.

**Note:** The switch automatically logs you out of the management interface after five minutes of inactivity. If this happens to you, simply log back in again.

- By default, multiple command interpreter management session are allowed via either the console port or Telnet. However, no more than five concurrent login sessions are allowed.
- Use the `configure multi-login` command in the configuration mode to limit concurrent logins to one. Console port access has higher priority.

### 34.2.1 The Console Port

Connect to the switch's console port using a terminal emulation software configured to the following settings:

- VT100 terminal emulation
- 9600 bps
- No parity
- 8 data bits
- 1 stop bit
- No flow control

#### 34.2.1.1 Initial Screen

When you turn on your switch, it performs several internal tests as well as line initialization. You can view the initialization information using the console port. After the initialization, the login screen displays (refer to Section 34.3 on page 234).

```
Copyright (c) 1994 - 2006 ZyXEL Communications Corp.
initialize mgmt, ethernet address: 00:13:49:00:00:01
initialize switch, ethernet address: 00:13:49:00:00:02
Initializing switch unit 0...
Initializing VLAN Database...
Initializing IP Interface...
Initializing Advanced Applications...
Initializing Command Line Interface...
Initializing Web Interface...
Press ENTER to continue...
```

Use the following steps to telnet into your switch.

1. For local management, connect your computer to the RJ-45 management port (labeled **MGMT**) on the switch.
2. Make sure your computer IP address and the switch IP address are on the same subnet. In Windows, click **Start** (usually in the bottom left corner), **Run** and then type `telnet 192.168.0.1` (the default management IP address) and click **OK**.
3. A login screen displays (refer to Section 34.3 on page 234).

## 34.3 The Login Screen

After you have successfully established a connection to the switch using a direct console connection or Telnet, a login screen displays as shown below. For your first login, enter the default administrator login username "admin" and password "1234".

```
Enter User Name : admin
Enter Password : XXXX
```

## 34.4 Command Syntax Conventions

The rules of the commands are listed next.

- The command keywords are in `courier new font`.
- The required fields in a command are enclosed in angle brackets <>, for instance, `ping <ip>` means that you must specify an IP number for this command.
- The optional fields in a command are enclosed in square brackets [], for instance,

```
configure snmp-server [contact <system contact>] [location
<system location>]
```

means that the contact and location fields are optional.

- "Command" refers to a command used in the command line interface (CI command).
- The | symbol means "or".
- The entry <cr> in the command lines refers to carriage return. Press [ENTER] or carriage return after a command to execute the command.
- Use the up or down arrow key to scroll through the command history list.
- You may enter a unique part of a command and press [TAB] to have the switch automatically display the full command. For example, if you enter "`config`" and press [TAB], the full command of "configure" automatically displays.
- Each interface refers to an Ethernet port on the switch. Commands configured after the interface command correspond to those ports.
- Type multiple ports or port ranges separated by a comma. Ranges of port numbers are typed separated by a dash.

## 34.5 Changing the Password

This command is used to change the password for Enable mode. By default the same password is used to enter the command line interface (CLI) and Enable and Config modes of the CLI.

The password you change with this command is required to enter Enable and Config modes of the CLI.

Syntax:

```
password <password>
```

where

`password <password>` = Specifies the new password (up to 32 alphanumeric characters) users have to type in to enter Enable and Config modes.

## 34.6 Privilege Levels

You can use a command whose privilege level is equal to or less than that of your login account. For example, if your login account has a privilege level of 12, you can use all commands with privilege levels from 0 to 12. 0 privilege level commands are available to all login accounts.

**Note:** If you use an external RADIUS server to authenticate users, you can use a VSA (Vendor Specific Attribute) to configure a privilege level for an account on the RADIUS server. See Section 16.1.1.1 on page 115 for more information.

Use the following commands to specify privilege levels for login accounts.

Syntax:

```
logins username <username> password <password>
logins username <username> privilege <0-14>
```

where

| | | |
|---|---|---|
| `username <username>` | = | Specifies a new user (up to 32 alphanumeric characters). Enter a user name to change the settings of an existing account. |
| `password <password>` | = | Specifies the new password (up to 32 alphanumeric characters) for this user. |
| `privilege <0-14>` | = | Assigns a privilege level for the user. |

## 34.7 Command Modes

There are three command modes: **User**, **Enable** and **Configure**. The modes (and commands) available to you depend on what level of privilege your account has. See Section 34.6 on page 235 for more information on setting up privilege levels.

When you first log into the command interpreter with a read-only account (having a privilege of 0 to 12), the initial mode is the User mode. The User mode commands are a subset of Enable mode commands. The User mode command prompt ends with an angle bracket (>).

To enter Enable mode, type `enable` and enter the administrator password when prompted (the default is 1234). When you enter Enable mode, the command prompt changes to the pound sign (`#`). If you log into the command interpreter as an administrator you automatically enter Enable mode.

The following table describes command interpreter modes and how to access them.

**Table 81** Command Interpreter Mode Summary

| MODE | .DESCRIPTION | HOW TO LOGIN/ ACCESS | PROMPT |
|---|---|---|---|
| User | Commands available in this mode are a subset of enable mode. You can perform basic tests and display general system information. | Default login level for a read-only account. | `ras>` |
| Enable | Commands available in this mode allow you to save configuration settings, reset configuration settings as well as display further system information. This mode also contains the `configure` command which takes you to config mode. | Default login level for accounts with a privilege of 13 or 14.<br>Read-only accounts (with a privilege of 0-12) need to type the `enable` command and enter enable mode password. | `ras#` |

**Table 81** Command Interpreter Mode Summary (continued)

| MODE | .DESCRIPTION | HOW TO LOGIN/ ACCESS | PROMPT |
|---|---|---|---|
| Config | Commands available in this mode allow you to configure settings that affect the switch globally. | Type `config` in enable mode. | `ras(config)#` |
| Command modes that follow are sub-modes of the config mode and can only be accessed from within the config mode. | | | |
| Config-vlan | This is a sub-mode of the config mode and allows you to configure VLAN settings. | Type `vlan` followed by a number (between 1 to 4094). For example, `vlan 10` to configure settings for VLAN 10. | `ras(config-vlan)#` |
| Config-interface | This is a sub-mode of the config mode and allows you to configure port related settings. | Type `interface port-channel` followed by a port number. For example, `interface port-channel 10` to configure port 10 on the switch. | `ras(config-interface)#` |
| Config-mvr | This is a sub-mode of the config mode and allows you to configure multicast VLAN settings. | To enter `MVR` mode, enter `mvr` followed by a VLAN ID (between 1 and 4094). For example, enter `mvr 2` to configure multicast settings on VLAN 2. | `ras(config-mvr)#` |

Enter `exit` to quit from the current mode or enter `logout` to exit the command interpreter.

## 34.8 Getting Help

The system includes a help facility to provide you with the following information about the commands:

- List of available commands under a command group.
- Detailed descriptions of the commands.

### 34.8.1 List of Available Commands

Enter "help" to display a list of available commands and the corresponding sub commands.

```
ras> help
  Commands available:

  help
  logout
  exit
  history
  enable
  show ip <cr>
  show hardware-monitor <C|F>
  show system-information
  ping <ip|host-name> <cr>
  ping <ip|host-name> [vlan <vlan-id>][..]
  ping help
  traceroute <ip|host-name> <cr>
  traceroute <ip|host-name> [vlan <vlan-id>][..]
  traceroute help
  ssh <1|2> <[user@]dest-ip> <cr>
  ssh <1|2> <[user@]dest-ip> [command </>]
ras>
```

Enter "?" to display a list of commands you can use.

```
ras> ?
    enable                    Turn on privileged commands
    exit                      Exit from the EXEC
    help                      Description of the interactive help system
    history                   Show a list of previously run commands
    logout                    Exit from the EXEC
    ping                      Exec ping
    show                      Show system information
    ssh                       SSH client
    traceroute                Exec traceroute
ras>
```

Enter <command> help to display detailed sub commands and parameters.

```
ras> ping help
  Commands available:

  ping <ip|host-name>
    <
      [ in-band|out-of-band|vlan <vlan-id> ]
      [ size <0-1472> ]
      [ -t ]
    >
ras>
```

Enter `<command> ?` to display detailed help information about the sub commands and parameters.

```
ras> ping ?
    <ip|host-name>            destination ip address
    help                      Description of ping help

ras>
```

## 34.9 Using Command History

The switch keeps a list of recently used commands available to you for reuse. You can use any commands in the history again by pressing the up (↑) or down (↓) arrow key to scroll through the previously used commands and press [ENTER]. Use the history command to display the list of commands.

```
ras> history
  enable
  exit
  show ip
  history
ras>
```

## 34.10 Saving Your Configuration

After you set the switch settings with the configuration commands, use the `write memory` command to save the changes permanently.

**Note:** The `write memory` command is not available in User mode.

You must save your changes after each CLI session. All unsaved configuration changes are lost once you restart the switch.

```
ras# write memory
```

### 34.10.1 Switch Configuration File

When you configure the switch using either the CLI (Command Line Interface) or web configurator, the settings are saved as a series of commands in a configuration file on the switch. You can perform the following with a configuration file:

- Back up switch configuration once the switch is set up to work in your network.
- Restore switch configuration.

- Use the same configuration file to set all switches (of the same model) in your network to the same settings.

**Note:** You may also edit a configuration file using a text editor.

Make sure you use valid commands. The switch rejects configuration files with invalid or incomplete commands.

### 34.10.2 Logging Out

In User or Enable mode, enter the `exit` or `logout` command to log out of the CLI. In Config mode entering `exit` takes you out of the Config mode and into Enable mode and entering `logout` logs you out of the CLI.

## 34.11 Command Summary

The following sections summarize the commands available in the switch together with a brief description of each command. Commands listed in the tables are in the same order as they are displayed in the CLI. See the related section in the User's Guide for more background information.

### 34.11.1 User Mode

The following table describes the commands available for User mode.

**Table 82** Command Summary: User Mode

| COMMAND | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|
| `help` | | Displays help information. | 0 |
| `logout` | | Exits from the CLI. | 0 |
| `exit` | | Logs out from the CLI. | 0 |
| `history` | | Displays a list of previously command(s) that you have executed. The switch stores up to 256 commands in history. | 0 |
| `enable` | | Accesses Enable (or privileged) mode. See Section 34.11.2 on page 241. | 0 |
| `show` | `ip` | Displays IP related information. | 0 |
| | `hardware-monitor <C\|F>` | Displays current hardware monitor information with the specified temperature unit (Celsius C or Fahrenheit F). | 0 |
| | `system-information` | Displays general system information. | 0 |
| `ping` | `<IP\|host-name>` | Sends Ping request to an Ethernet device. | 0 |

**Table 82** Command Summary: User Mode (continued)

| COMMAND | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|
| | `<IP\|host-name> [vlan <vlan-id>] [size <0-1472>] [-t]` | Sends Ping request to an Ethernet device in the specified VLAN(s) with the specified parameters. | 0 |
| | `help` | Displays command help information. | 0 |
| `traceroute` | `<ip\|host-name>` | Determines the path a packet takes to a device. | 0 |
| | `<ip\|host-name> [vlan <vlan-id>] [ttl <1-255>] [wait <1-60>] [queries <1-10>]` | Determines the path a packet takes to a device in a VLAN. | 0 |
| | `help` | Displays command help information. | 0 |
| `ssh` | `<1\|2> <[user@]dest-ip>` | Connects to an SSH server with the specified SSH version. | 0 |

## 34.11.2 Enable Mode

The following table describes the commands available for Enable mode.

**Table 83** Command Summary: Enable Mode

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| `help` | | | Displays help information. | 13 |
| `logout` | | | Exits Enable (or privileged) mode. | 13 |
| `exit` | | | Exits Enable (or privileged) mode. | 13 |
| `history` | | | Displays a list of command(s) that you have previously executed. | 13 |
| `enable` | | | Accesses Enable (or privileged) mode. | 13 |
| `disable` | | | Exits Enable (or privileged) mode. | 13 |
| `configure` | | | Accesses Configuration mode. See Section 34.11.3 on page 246. | 13 |
| `stk-port-test` | | | Tests stack port list. | 13 |
| `no` | `logging` | | Clears system logs. | 13 |
| | `arp` | | Flushes the ARP (Address Resolution Protocol) table. | 13 |
| | `interface <port-number>` | | Clears the interface status of the specified port(s). | 13 |
| `show` | `ip` | | Displays IP related information. | 13 |
| | | `arp` | Displays the ARP table. | 13 |
| | | `tcp` | Displays TCP related information. | 13 |

**Table 83** Command Summary: Enable Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | | udp | Displays UDP related information. | 13 |
| | | route | Displays IP routing information. | 13 |
| | | route static | Displays IP static route information. | 13 |
| | hardware-monitor <C\|F> | | Displays current hardware monitor information with the specified temperature unit (Celsius C or Fahrenheit F). | 13 |
| | system-information | | Displays general system information. | 13 |
| | vlan1q | gvrp | Displays GVRP settings. | 13 |
| | | port-isolation | Displays port isolation settings. | 13 |
| | spanning-tree | config | Displays Spanning Tree Protocol (STP) settings. | 13 |
| | mrstp <treeIndex> | | Displays the STP settings for the specific tree. | 13 |
| | mac | address-table <all [mac\|vid\|port]> | Displays MAC address table.<br>You can sort by MAC address, VID or port. | 13 |
| | | address-table static | Displays static MAC address table. | 13 |
| | | address-table count | Displays the number of static MAC address tables. | 13 |
| | lacp | | Displays LACP (Link Aggregation Control Protocol) settings. | 13 |
| | trunk | | Displays link aggregation information. | 13 |
| | radius-server | | Displays RADIUS server settings. | 13 |
| | port-access-authenticator | | Displays all port authentication settings. | 13 |
| | | <port-list> | Displays port authentication settings on the specified port(s). | 13 |
| | port-security | | Displays all port security settings. | 13 |
| | | <port-list> | Displays port security settings on the specified port(s). | 13 |
| | snmp-server | | Displays SNMP settings. | 13 |
| | logins | | Displays login account information. | 13 |
| | service-control | | Displays service control settings. | 13 |
| | remote-management | | Displays all secured client information. | 13 |
| | | <index> | Displays the specified secured client information. | 13 |

**Table 83** Command Summary: Enable Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | classifier | | Displays all classifier related information. | 13 |
| | | <name> | Displays the specified classifier related information. | 13 |
| | policy | | Displays all policy related information. | 13 |
| | | <name> | Displays the specified policy related information. | 13 |
| | interface <port-list> | | Displays current interface status. | 13 |
| | interfaces config <port-list> | | Displays current interface configuration on the port(s). | 13 |
| | | bandwidth-control | Displays bandwidth control settings on the port(s). | 13 |
| | | egress | Displays outgoing port information on the port(s). | 13 |
| | | bstorm-control | Displays broadcast storm control settings on the port(s). | 13 |
| | | igmp-immediate-leave | Displays IGMP immediate leave settings on the port(s). | 13 |
| | | igmp-filtering | Displays IGMP filter profile settings on the port(s). | 13 |
| | | igmp-group-limited | Displays IGMP group settings on the port(s). | 13 |
| | | igmp-query-mode | Displays IGMP query mode settings on the port(s). | 13 |
| | | protocol-based-vlan | Displays protocol based VLAN settings on the port(s). | 13 |
| | vlan | | Displays the status of all VLANs. | 13 |
| | | <vlan-id> | Displays the status of the specified VLAN. | 13 |
| | running-config | | Displays current operating configuration. | 13 |
| | | help | Displays detailed information and parameters for this command. | 13 |
| | | interface port-channel <port-list> [bandwidth-limit...] | Displays current operating configuration on a port by port basis. Optionally specifies which settings are displayed. | 13 |
| | timesync | | Displays time server information. | 13 |
| | time | | Displays current system time and date. | 13 |
| | garp | | Displays GARP information. | 13 |

**Table 83** Command Summary: Enable Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | `loginPrecedence` | | Displays login precedence settings. | 13 |
| | `logging` | | Displays system logs. | 13 |
| | `vlan-stacking` | | Displays VLAN stacking configuration. | 13 |
| | `ssh` | | Displays general SSH settings. | 13 |
| | | `known-hosts` | Displays known SSH hosts information. | 13 |
| | | `key <rsa1\|rsa\|dsa>` | Displays internal SSH public and private key information. | 13 |
| | | `session` | Displays current SSH session(s). | 13 |
| | `https` | | Displays the HTTPS information. | 13 |
| | | `session` | Displays current HTTPS session(s). | 13 |
| | | `certificate` | Displays the HTTPS certificates. | 13 |
| | | `key <rsa\|dsa>` | Displays the HTTPS key. | 13 |
| | | `timeout` | Displays the HTTPS session timeout. | 13 |
| | `multi-login` | | Displays multi-login information | 13 |
| | `plt` | | Displays Packet Loop Test (PLT). | 13 |
| | `mac-aging-time` | | Displays MAC learning aging time. | 13 |
| | `cluster` | | Displays cluster management status. | 13 |
| | | `candidates` | Displays cluster candidate information. | 13 |
| | | `member` | Displays the MAC address of the cluster member(s). | 13 |
| | | `member mac <mac-addr>` | Displays the status of the cluster member(s). | 13 |
| | | `members config` | Displays the configuration of the cluster member(s). | 13 |
| | `igmp-filtering profile` | | Displays IGMP filter profile settings. | 13 |
| | `igmp-snooping` | | Displays IGMP snooping settings. | 13 |
| | `multicast` | | Displays multicast settings. | 13 |
| | `mvr` | | DIsplays all MVR (Multicast VLAN Registration) settings. | 13 |
| | | `<vlan-id>` | DIsplays specified MVR information. | 13 |
| | `diffserv` | | Displays DiffServ settings on the switch. | 13 |
| `igmp-flush` | | | Removes all IGMP information. | 13 |

**Table 83** Command Summary: Enable Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| kick tcp | <Session ID> | | Resets a TCP connection. Use the show ip tcp command to get the **Session ID**. | 13 |
| mac-flush | | | Clears the MAC address table. | 13 |
| | <port-num> | | Removes all learned MAC address on the specified port(s). | 13 |
| erase | running-config | | Resets to the factory default settings. | 13 |
| | | interface port-channel <port-list> [bandwidth-limit...] | Resets to the factory default settings on a per port basis and optionally on a per feature configuration basis. | 13 |
| baudrate | <1\|2\|3\|4\|5> | | Changes the console port speed. Choices are 1 (9600), 2 (19200), 3(38400), 4 (57600) and 5 (115200). | 13 |
| boot | config <index> | | Restarts the system with the specified configuration file. | 13 |
| reload | config <index> | | Restarts the system and use the specified configuration file. | 13 |
| write | memory | | Saves current configuration to the configuration file the switch is currently using. | 13 |
| | | <index> | Saves current configuration to the specified configuration file on the switch. | 13 |
| copy | tftp flash <ip> <remote-file> | | Restores firmware via TFTP. | 13 |
| | tftp config <index> <ip> <remote-file> | | Restores configuration with the specified filename from the specified TFTP server. | 13 |
| | running-config tftp <ip> <remote-file> | | Backs up running configuration to the specified TFTP server with the specified file name. | 13 |
| | copy running-config interface port-channel <port> <port-list> | | Clones (copies) the attributes from the specified port to other ports. | 13 |
| | copy running-config interface port-channel <port> <port-list> | [bandwidth-limit ....] | Copies the specified attributes from one port to other ports. | 13 |

**Table 83** Command Summary: Enable Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| cable-diagnostics | <port-list> | | Performs a basic connectivity test on the ports. Displays "Ok" if connector is inserted in the port, "Open" if no connector is inserted in the port or "Unknown" if this test cannot determine the status. | 13 |
| ping | <ip\|host-name> | | Sends Ping request to an Ethernet device. | 13 |
| | | [vlan <vlan-id>][..] | Sends Ping request to an Ethernet device in the specified VLAN(s). | 13 |
| | help | | Displays command help information. | 13 |
| traceroute | <ip\|host-name> [in-band\|out-of-band\|vlan <vlan-id>][ttl <1-255>] [wait <1-60>] [queries <1-10>] | | Determines the path a packet takes to a device. | 13 |
| | help | | Displays command help information. | 13 |
| ssh | <1\|2> <[user@]dest-ip> | | Connects to an SSH server with the specified SSH version. | 13 |
| | | [command </>] | Connects to an SSH server with the specified SSH version and addition commands to be executed on the server. | 13 |

## 34.11.3 General Configuration Mode

The following table lists the commands in Configuration (or Config) mode.

**Table 84** Command Summary: Configuration Mode

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| help | | | Displays help information. | 13 |
| logout | | | Exits from the CLI. | 13 |
| history | | | Displays a list of previous command(s) that you have executed. | 13 |
| exit | | | Exits from Config mode into Enable mode. | 13 |
| mode | zynos | | Changes the CLI mode to the ZyNOS format. | 13 |
| password | <password> | | Change the password for accessing Enable mode. | 14 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| no | ip | | Sets the management IP address to the default value. | 13 |
| | | route <ip> <mask> | Removes a specified IP static route. | 13 |
| | | route <ip> <mask> inactive | Enables a specified IP static route. | 13 |
| | igmp-filtering | | Clears the IGMP filtering settings on the switch. | 13 |
| | | profile <name> | Deletes the IGMP filtering profile. | 13 |
| | | profile <name> start-address <ip> end-address <ip> | Deletes a rule in the IGMP filtering profile. | 13 |
| | igmp-snooping | | Disables IGMP snooping. | 13 |
| | mac-forward | mac <mac-addr> vlan <vlan-id> interface <interface-id> | Removes the specified MAC forwarding entry, belonging to a VLAN group (if any) forwarded through an interface(s). | 13 |
| | | mac <mac-addr> vlan <vlan-id> interface <interface-id> inactive | Enables the specified MAC address, belonging to a VLAN group (if any) forwarded through an interface(s). | 13 |
| | mac-filter | mac <mac-addr> vlan <vlan-id> inactive | Enables the specified MAC-filter rule. | 13 |
| | | mac <mac-addr> vlan <vlan-id> | Disables the specified MAC filter rule. | 13 |
| | mirror-port | | Disables port mirroring on the switch. | 13 |
| | lacp | | Disables the link aggregation control protocol (dynamic trunking) on the switch. | 13 |
| | trunk | <T1\|T2\|T3\|T4\|T5\|T6> | Disables the specified trunk group. | 13 |
| | | <T1\|T2\|T3\|T4\|T5\|T6> lacp | Disables LACP in the specified trunk group. | 13 |
| | | <T1\|T2\|T3\|T4\|T5\|T6> interface <port-list> | Removes ports from the specified trunk group. | 13 |
| | bcp-transparency | | Disables Bridge Control Protocol (BCP) transparency. | 13 |
| | storm-control | | Disables broadcast storm control. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | bandwidth-control | | Disable bandwidth control on the switch. | 13 |
| | vlan1q | gvrp | Disables GVRP on the switch. | 13 |
| | | port-isolation | Disables port isolation. | 13 |
| | spanning-tree | | Disables STP. | 13 |
| | | <port-list> | Disables STP on listed ports. | 13 |
| | mrstp | <treeIndex> | Disables the specified STP configuration (tree 1-6). | 13 |
| | mrstp | interface <port-list> | Disables the STP assignment from the specified port(s). | 13 |
| | timesync | | Disables timeserver settings. | 13 |
| | radius-server | <index> | Disables the use of authentication from the specified RADIUS server. | 13 |
| | port-access-authenticator | | Disables port authentication on the switch. | 13 |
| | | <port-list> | Disables authentication on the listed ports. | 13 |
| | | <port-list> reauthenticate | Disables the re-authentication mechanism on the listed port(s). | 13 |
| | port-security | | Disables port security on the switch. | 13 |
| | | <port-list> | Disables port security on the specified ports. | 13 |
| | | <port-list> learn inactive | Enables MAC address learning on the specified ports. | 13 |
| | snmp-server | trap-destination <ip> | Disables sending of SNMP traps to a station. | 13 |
| | logins | username <name> | Disables login access to the specified name. | 14 |
| | service-control | telnet | Disables telnet access to the switch. | 13 |
| | | ftp | Disables FTP access to the switch. | 13 |
| | | http | Disables web browser control to the switch. | 13 |
| | | ssh | Disables SSH (Secure Shell) server access to the switch. | 13 |
| | | https | Disables secure web browser access to the switch. | 13 |
| | | icmp | Disables ICMP access to the switch such as pinging and tracerouting. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | | snmp | Disables SNMP management. | 13 |
| | remote-management | <index> | Clears a secure client set entry from the list of secure clients. | 13 |
| | | <index> service <[telnet] [ftp] [http] [icmp] [snmp] [ssh] [https]> | Disables a secure client set entry number from using the selected remote management service(s). | 13 |
| | classifier | <name> | Disables the classifier. Each classifier has one rule.<br>If you disable a classifier you cannot use policy rule related information. | 13 |
| | | <name> inactive | Enables a classifier. | 13 |
| | policy | <name> | Deletes the policy. A policy sets actions for classifier traffic. | 13 |
| | | <name> inactive | Enables a policy. | 13 |
| | vlan | <vlan-id> | Deletes the static VLAN entry. | 13 |
| | dhcp-relay | | Disables DHCP relay. | 13 |
| | | option | Disables the relay agent information option 82. | 13 |
| | | information | System name is not appended to option 82 information field. | 13 |
| | vlan-stacking | | Disables VLAN stacking on the switch. | 13 |
| | ssh | key <rsa1\|rsa\|dsa> | Disables the secure shell server encryption key. Your switch supports SSH versions 1 and 2 using RSA and DSA authentication. | 13 |
| | | known-hosts | Removes all remote hosts. | 13 |
| | | known-hosts <host-ip> | Removes the specified remote host from the list of all known hosts. | 13 |
| | | known-hosts <host-ip> [1024\|ssh-rsa\|ssh-dsa] | Removes remote known hosts with the specified public key (1024-bit RSA1, RSA or DSA). | 13 |
| | https | timeout | Resets the session timeout to the default of 300 seconds. | 13 |
| | multi-login | | Disables another administrator from logging into Telnet. | 14 |
| | cluster | | Disables cluster management on the switch. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | cluster member | <mac-address> | Removes the cluster member. | 13 |
| | mvr | <vlan-id> | Disables MVR on the switch. | 13 |
| | fe-spq | | Disables Strict Priority Queuing on the switch. | 13 |
| | syslog | | Disables syslog logging. | 13 |
| | | server <ip-address> | Disables syslog logging to the specified syslog server. | 13 |
| | | server <ip-address> inactive | Enables syslog logging to the specified syslog server. | 13 |
| | | type [type] | DIsables syslog logging for the specified log type (sys, link, config, error or report). | 13 |
| vlan | <1-4094> | | Enters the VLAN configuration mode. See Section 34.11.5 on page 263 for more information. | 13 |
| vlan-type | <802.1q\|port-based> | | Specifies the VLAN type. | 13 |
| igmp-snooping | | | Enables IGMP snooping. | 13 |
| | host-timeout | <1-16711450> | Sets the host timeout value. | 13 |
| | leave-timeout | <1-16711450> | Sets the leave timeout value | 13 |
| | unknown-multicast-frame <drop\|flooding> | | Sets how to treat traffic from unknown multicast group. | 13 |
| | reserved-multicast-group <drop\|flooding> | | Sets how to treat traffic belonging to reserved multicast groups. | 13 |
| igmp-filtering | | | Enables IGMP filtering on the switch. | 13 |
| | profile <name> start-address <ip> end-address <ip> | | Sets the range of multicast address(es) in a profile. | 13 |
| interface | port-channel <port-list> | | Enables a port or a list of ports for configuration. See Section 34.11.4 on page 259 for more details. | 13 |
| spq | | | Sets the queuing method to SPQ (Strictly Priority Queuing). | 13 |
| wfq | | | Sets the queuing method to WFQ (Weighted Fair Queuing). | 13 |
| wrr | | | Sets the queuing method to WRR (Weighted Round Robin). | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| fe-spq <q0\|q1\|..\|q7> | | | Sets the switch to use SPQ to service the subsequent queue(s) after and including the specified queue for the 10/100 Mbps Ethernet ports. | 13 |
| ip | route | <ip> <mask> <next-hop-ip> | Creates a static route. | 13 |
| | | <ip> <mask> <next-hop-ip> [metric <metric>] [name <name>] [inactive] | Sets the metric of a static route or deactivates a static route. | 13 |
| | name-server | <ip> | Sets the IP address of a domain name server. | 13 |
| | address default-gateway | <ip> | Sets the default gateway's IP address for the out-of-band management port. | 13 |
| | address | <ip> <mask> | Sets the IP address and subnet mask of the out-of-band management port. | 13 |
| mac-forward | name <name> mac <mac-addr> vlan <vlan-id> interface <interface-id> | | Configures a static MAC address forwarding rule. | 13 |
| | | inactive | Disables a static MAC address forwarding rule. | 13 |
| mac-filter | name <name> mac <mac-addr> vlan <vlan-id> drop <src/dst/both> | | Configures a static MAC address port filtering rule. | 13 |
| | | inactive | Disables a static MAC address port filtering rule. | 13 |
| mirror-port | | | Enables port mirroring. | 13 |
| | <port-num> | | Sets the monitor port (the port to which traffic is copied for analysis). | 13 |
| lacp | | | Enables Link Aggregation Control Protocol (LACP). | 13 |
| | system-priority | <1-65535> | Sets the priority of an active port using LACP. | 13 |
| trunk | <T1\|T2\|T3\|T4\|T5\|T6> | | Activates a trunk group. | 13 |
| | <T1\|T2\|T3\|T4\|T5\|T6> lacp | | Enables LACP for a trunk group. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | <T1\|T2\|T3\|T4\|T5\|T6> interface <port-list> | | Adds a port(s) to the specified trunk group. | 13 |
| | interface <port-list> timeout <lacp-timeout> | | Defines the port number and LACP timeout period. | 13 |
| cluster | <vlan-id> | | Sets the cluster management VLAN ID. | 13 |
| | name <cluster name> | | Configures a name to identify the cluster manager. | 13 |
| | member <mac-address> password <password-str> | | Sets the cluster member switch's hardware MAC address and password. | 13 |
| | rcommand <mac-address> | | Logs into a cluster member switch. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| classifier | <name> <[ packet-format <802.3untag\|802.3tag\|EtherIIuntag\|EtherIItag>] [ priority <0-7> ] [ vlan <vlan-id> ] [ ethernet-type <ether-num\|ip\|ipx\|arp\|rarp\|appletalk\|decnet\|sna\|netbios\|dlc> ] [ source-mac <src-mac-addr> ] [ source-port <port-num> ] [ destination-mac <dest-mac-addr> ] [ dscp <0-63> ] [ ip-protocol <protocol-num\|tcp\|udp\|icmp\|egp\|ospf\|rsvp\|igmp\|igp\|pim\|ipsec> [establish-only] ] [ source-ip <src-ip-addr> [mask-bits <mask-bits>] ] [ source-socket <socket-num> ] [ destination-ip <dest-ip-addr> [mask-bits <mask-bits>] ] [ destination-socket <socket-num> ] [ inactive ] > | | Configures a classifier. A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming port number. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| policy | <name> classifier <classifier-list> < [ vlan<vlan-id> ] [ egress-port <port-num> ] [ priority <0-7> ] [ dscp <0-63>] [ tos <0-7> ] [ bandwidth <bandwidth> ] [ outgoing-packet-format <tagged\|untagged> ] [ out-of-profile-dscp <0-63> ] [ forward-action <drop\|forward>] [ queue-action <prio-set\|prio-queue\|prio-replace-tos>] [ diffserv-action <diff-set-tos\|diff-replace-priority\|diff-set-dscp> ] [ outgoing-mirror ] [ outgoing-eport] [ outgoing-non-unicast-eport ] [ outgoing-set-vlan ] [ metering] [ out-of-profile-action <[ change-dscp ][ drop ][ forward ][set-drop-prec]> ][ inactive ] > | | Configures a policy. A classifier distinguishes traffic into flows based on the configured criteria. A policy rule ensures that a traffic flow gets the requested treatment in the network. | 13 |
| radius-server | host <index> <ip> | | Specifies the IP address of RADIUS server 1 or RADIUS server 2 (index =1 or index =2). | 13 |
| | | [auth-port <socket-number>] [key <key-string>] | Sets the port number and key of the external RADIUS server. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | `timeout <1-1000>` | | Specifes the RADIUS server timeout value. | 13 |
| | `mode` | `<priority\|round-robin>` | Specifies the mode for RADIUS server selection. | 13 |
| `port-access-authenticator` | | | Enables 802.1x authentication on the switch. | 13 |
| | `<port-list>` | | Enables 802.1x authentication on the specified port(s). | 13 |
| | | `reauthenticate` | Sets a subscriber to periodically re-enter his or her username and password to stay connected to a specified port. | 13 |
| | | `reauth-period <reauth-period>` | Specifies how often a client has to re-enter the username and password to stay connected to the specified port(s). | 13 |
| `port-security` | | | Enables port security on the switch. | 13 |
| | `<port-list>` | | Enables the port security feature on the specified port(s). | 13 |
| | | `learn inactive` | Disables MAC address learning on the specified port(s). | 13 |
| | | `address-limit <number>` | Limits the number of (dynamic) MAC addresses that may be learned on a port. | 13 |
| | | `MAC-freeze` | Disables MAC address learning and enables port security.<br>**Note:** All previously learned dynamic MAC addresses are saved to the static MAC address table. | 13 |
| `vlan1q` | `gvrp` | | Enables GVRP. | 13 |
| | `port-isolation` | | Enables port-isolation. | 13 |
| `garp` | `join <100-65535> leave <msec> leaveall <msec>` | | Configures GARP time settings. | 13 |
| `spanning-tree` | | | Enables STP on the switch. | 13 |
| | `priority <0-61440>` | | Sets the bridge priority of the switch. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | hello-time <1-10> maximum-age <6-40> forward-delay <4-30> | | Sets Hello Time, Maximum Age and Forward Delay. | 13 |
| | <port-list> | | Enables STP on a specified port. | 13 |
| | <port-list> path-cost <1-65535> | | Sets the STP path cost for a specified port. | 13 |
| | <port-list> priority <0-255> | | Sets the priority for a specified port. | 13 |
| | help | | Displays help information. | 13 |
| mrstp | <treeIndex> | | Activates the specified STP configuration. | 13 |
| | interface <port-list> | | Activates STP on the specified ports. | 13 |
| | | path-cost <1-56535> | Sets a path cost to the specified ports. | 13 |
| | | priority <0-255> | Sets the priority value to the specified ports for STP. | 13 |
| | | treeIndex <1-6> | Assigns a specific STP configuration to the ports. | 13 |
| | help | | Displays the detailed help for the mrstp command. | 13 |
| hostname | <name_string> | | Sets the switch's name for identification purposes. | 13 |
| time | <Hour:Min:Sec> | | Sets the time in hour, minute and second format. | 13 |
| | timezone <-1200\|...\|1200> | | Selects the time difference between UTC (formerly known as GMT) and your time zone. | 13 |
| | date <month/day/year> | | Sets the date in year, month and day format. | 13 |
| | help | | Displays help information. | 13 |
| timesync | <daytime\|time\|ntp> | | Sets the time server protocol. | 13 |
| | server <ip> | | Sets the IP address of your time server. | 13 |
| loginPrecedence | <LocalOnly \| LocalRADIUS \| RADIUSOnly> | | Select which database the switch should use (first) to authenticate a user. | 14 |
| bcp-transparency | | | Enables Bridge Control Protocol (BCP) transparency. | 13 |
| queue | priority <0-7> level <0-7> | | Sets the priority level-to-physical queue mapping. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| storm-control | | | Enables broadcast storm control on the switch. | 13 |
| bandwidth-control | | | Enables bandwidth control. | 13 |
| mac-aging-time | <10-3000> | | Sets learned MAC aging time. | 13 |
| snmp-server | get-community <property> | | Sets the get community. | 13 |
| | set-community <property> | | Sets the set community. | 13 |
| | trap-community <property> | | Sets the trap community. | 13 |
| | trap-destination <ip> | | Sets the IP addresses of up to four stations to send your SNMP traps to. | 13 |
| | [contact <system contact>] [location <system location>] | | Sets the geographic location and the name of the person in charge of this switch. | 13 |
| logins | username <name> password <pwd> | | Configures a default (read-only) account. | 14 |
| | username <name> | privilege <0-14> | Assigns a privilege level to user accounts. | 14 |
| service-control | icmp | | Allows ICMP access for services such as Ping. | 13 |
| | snmp | | Allows SNMP management. | 13 |
| | http <socket-number> <timeout> | | Allows HTTP access on the specified service port and defines the timeout period. | 13 |
| | telnet <socket-number> | | Allows Telnet access on the specified service port. | 13 |
| | ftp <socket-number> | | Allows FTP access on the specified service port. | 13 |
| | ssh <socket-number> | | Allows SSH access on the specified service port. | 13 |
| | https <socket-number> | | Allows HTTPS access on the specified service port. | 13 |
| remote-management | <index> | | Enables a specified secured client set. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | <index> start-addr <ip> end-addr <ip> service <[telnet] [ftp] [http] [icmp] [snmp] [ssh] [https]> | | Specifies a group of trusted computer(s) from which an administrator may use a service to manage the switch. | 13 |
| admin-password | <pw-string> <confirm-string> | | Changes the administrator password. | 14 |
| syslog | | | Enables syslog logging on the switch. | 13 |
| | server <ip-address> | | Enables syslog logging to the specified syslog server. | 13 |
| | server <ip-address> | inactive | Disables syslog logging to the specified syslog server. | 13 |
| | | level [0 ~ 7] | Sets the IP address of the syslog server and the severity level. | 13 |
| | type <type> facility [local 1 ..7] | | Sets the log type and the file location on the syslog server. | 13 |
| vlan-stacking | | | Enables VLAN stacking on the switch. | 13 |
| | <SPTPID> | | Sets the SP TPID (Service Provider Tag Protocol Identifier). | 13 |
| default-management | <in-band\|out-of-band> | | Specifies through which traffic flow the switch is to send packets. | 13 |
| ssh | known-hosts <host-ip> <1024\|ssh-rsa\|ssh-dsa> <key> | | Adds a remote host to which the switch can access using SSH service. | 13 |
| https | cert-regeneration <rsa\|dsa> | | Re-generates a certificate. | 13 |
| | timeout <0-65535> | | Sets the HTTPS timeout period. | 13 |
| multi-login | | | Enables multi-login. | 14 |
| mvr <vlan-id> | | | Enters the MVR (Multicast VLAN Registration) configuration mode. See Section 34.11.6 on page 264 for more information. | 13 |
| dhcp-relay | | | Enables DHCP relay. | 13 |
| | helper-address <svr_ip> [svr2_ip] [svr3_ip] | | Sets the IP addresses of up to 3 DHCP servers. | 13 |

**Table 84** Command Summary: Configuration Mode (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | option | | Allows the switch to add DHCP relay agent information. | 13 |
| | information | | Allows the switch to add system name to agent information. | 13 |
| diffserv | | | Enables DiffServ on the switch. | 13 |
| | dscp <0-63> | priority <0-7> | Maps DSCP value with an 802.1p value. | 13 |

## 34.11.4 interface port-channel Commands

The following table lists the `interface port-channel` commands in configuration mode. Use these commands to configure the ports.

**Table 85** interface port-channel Commands

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| interface port-channel <port-list> | | | Enables a port or a list of ports for configuration. | 13 |
| | weight <wt1> <wt2> ... <wt8> | | Sets the interface to use WFQ weighting. A weight value of one to eight is given to each variable from wt 1 to wt 8. | 13 |
| | egress set <port-list> | | Sets the outgoing traffic port list for a port-based VLAN. | 13 |
| | igmp-immediate-leave | | Enables IGMP immediate leave on the port. | 13 |
| | igmp-filtering profile <name> | | Sets the IGMP filtering profile for this port. | 13 |
| | igmp-group-limited | | Limits the number of multicast groups. | 13 |
| | igmp-group-limited number <number> | | Sets the number of multicast groups this port is allowed to join. | 13 |
| | igmp-querier-mode <auto\|fixed\|edge> | | Sets the IGMP querier mode of a port.<br>Selects `auto` to treat the IGMP queries normally, `fixed` to always treat the port as a querier port no matter there is a query or `edge` to treat the port as a non-querier port which drops any IGMP queries received. | 13 |

**Table 85** interface port-channel Commands (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | pvid <1-4094> | | The default PVID is VLAN 1 for all ports. Sets a PVID in the range 1 to 4094 for the specified interface. | 13 |
| | ingress-check | | Enables the device to discard incoming frames for VLANs that are not included in a port member set. | 13 |
| | gvrp | | Enables this function to permit VLAN groups beyond the local switch. | 13 |
| | frame-type <all\|tagged\|untagged> | | Choose to accept both tagged and untagged incoming frames, just tagged incoming frames or just untagged incoming frames on a port. | 13 |
| | name <port-name-string> | | Sets a name for the port(s). Enter a descriptive name (up to nine printable ASCII characters). | 13 |
| | vlan-trunking | | Enables VLAN Trunking on ports connected to other switches or routers (but not ports directly connected to end users) to allow frames belonging to unknown VLAN groups to pass through the switch. | 13 |
| | flow-control | | Enables interface flow control. Flow control regulates transmissions to match the bandwidth of the receiving port. | 13 |
| | bandwidth-limit | | Enables ingress (pir), cir and egress limits on the port(s). | 13 |
| | | cir | Enables the guaranteed bandwidth limits for incoming traffic on the port(s). | 13 |
| | | cir <Kbps> | Sets the guaranteed bandwidth allowed for incoming traffic on the port(s). | 13 |
| | | pir | Enables bandwidth limits allowed for incoming traffic on the port(s). | 13 |
| | | pir <Kbps> | Sets the maximum bandwidth allowed for incoming traffic on the port(s). | 13 |
| | | egress | Enables bandwidth limits allowed for outgoing traffic on the port(s). | 13 |
| | | egress <Kbps> | Sets the maximum bandwidth allowed for outgoing traffic on the port(s). | 13 |
| | broadcast-limit | | Enables broadcast storm control limit on the switch. | 13 |
| | | <pkt/s> | Sets how many broadcast packets the interface receives per second. | 13 |

**Table 85** interface port-channel Commands (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | multicast-limit | | Enables the interface multicast limit. | 13 |
| | | <pkt/s> | Sets how many multicast packets the interface receives per second. | 13 |
| | dlf-limit | | Enables the Destination Lookup Failure (DLF) limit. | 13 |
| | | <pkt/s> | Sets the interface DLF limit in packets per second (pps). | 13 |
| | diffserv | | Enables DiffServ on the port(s). | 13 |
| | qos priority | <0 .. 7> | Sets the quality of service priority for an interface. | 13 |
| | mirror | | Enables port mirroring in the interface. | 13 |
| | | dir <ingress\|egress\|both> | Enables port mirroring for incoming, outgoing or both incoming and outgoing traffic.<br>Port mirroring copies traffic from one or all ports to another or all ports for external analysis. | 13 |
| | speed-duplex | <auto\|10-half\|10-full\|100-half\|100-full\|1000-full> | Sets the duplex mode (half or full) and speed (10, 100 or 1000 Mbps) of the connection on the interface. Selecting auto (auto-negotiation) makes one port able to negotiate with a peer automatically to obtain the connection speed and duplex mode that both ends support. | 13 |
| | bpdu-control <peer\|tunnel\|discard\|network> | | Sets how Bridge Protocol Data Units (BPDUs) are used in STP port states. | 13 |
| | no | egress set <port-list> | Disables the outgoing traffic port list for a port-based VLAN. | 13 |
| | | protocol-based-vlan ethernet-type <ethernet-type> | Disables protocol based VLAN of the specifed protocol on the port. | 13 |
| | | igmp-immediate-leave | Disables IGMP immediate leave on the port. | 13 |
| | | igmp-filtering profile | Disables IGMP filtering on the port. | 13 |
| | | igmp-group-limited | Disables IGMP group limitation. | 13 |
| | | ingress-check | Disables ingress checking on the port(s). | 13 |
| | | gvrp | Disable GVRP on the port(s). | 13 |
| | | flow-control | Disables flow control on the port(s). | 13 |

**Table 85** interface port-channel Commands (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | | vlan-trunking | Disables VLAN trunking on the port(s). | 13 |
| | | mirror | Disables port mirroring on the port(s). | 13 |
| | | bandwidth-limit | Disables bandwidth limit on the port(s). | 13 |
| | | broadcast-limit | Disables broadcast storm control limit on the switch. | 13 |
| | | multicast-limit | Disables multicast limit on the switch. | 13 |
| | | dlf-limit | Disables destination lookup failure (DLF) limit on the switch. | 13 |
| | | inactive | Enables the port(s) on the switch. | 13 |
| | | intrusion-lock | Disables intrusion-lock on a port so that a port can be connected again after you disconnected the cable. | 13 |
| | inactive | | Disables the specified port(s) on the switch. | 13 |
| | help | | Displays a description of the interface port-channel commands. | 13 |
| | vlan-stacking role <normal\|access\|tunnel> | | Sets the VLAN stacking port roles of the specified interface. | 13 |
| | vlan-stacking SPVID <1-4094> | | Sets the service provider VID of the specified interface. | 13 |
| | vlan-stacking priority <0-7> | | Sets the priority of the specified interface in VLAN stacking. | 13 |
| | exit | | Exits from the interface port-channel command mode. | 13 |
| | intrusion-lock | | Enables intrusion lock on a port and a port cannot be connected again after you disconnected the cable. | 13 |
| | test | | Performs an interface loopback test. | 13 |
| | protocol-based-vlan name <name> ethernet-type <ethernet-type> vlan <vid> priority <0-7> | | Creates a protocol based VLAN with the specified parameters. | 13 |
| | | inactive | Disables the protocol based VLAN. | 13 |

## 34.11.5 config-vlan Commands

The following table lists the `vlan` commands in configuration mode.

**Table 86** Command Summary: config-vlan Commands

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| `vlan <1-4094>` | | | Creates a new VLAN group. | 13 |
| | `name <name-str>` | | Specifies a name for identification purposes. | 13 |
| | `normal <port-list>` | | Specifies the port(s) to dynamically join this VLAN group using GVRP | 13 |
| | `fixed <port-list>` | | Specifies the port(s) to be a permanent member of this VLAN group. | 13 |
| | `forbidden <port-list>` | | Specifies the port(s) you want to prohibit from joining this VLAN group. | 13 |
| | `untagged <port-list>` | | Specifies the port(s) you don't want to tag all outgoing frames transmitted with this VLAN Group ID. | 13 |
| | `inactive` | | Disables the specified VLAN. | 13 |
| | `help` | | Displays a list of available VLAN commands. | 13 |
| | `no` | `fixed <port-list>` | Sets fixed port(s) to normal port(s). | 13 |
| | | `forbidden <port-list>` | Sets forbidden port(s) to normal port(s). | 13 |
| | | `untagged <port-list>` | Enables VLAN tagging for outgoing traffic on the specified port(s). | 13 |
| | | `inactive` | Enables the specified VLAN. | 13 |
| | | `ip address inband-default dhcp-bootp` | Sets the default in-band interface to use a static IP address in this VLAN.<br>The switch will use the default IP address of 0.0.0.0 if you do not configure a static IP address. | 13 |
| | | `ip address <ip-address> <mask>` | Deletes the IP address and subnet mask from this VLAN. | 13 |
| | | `ip address default-gateway` | Deletes the default gateway from this VLAN. | 13 |
| | `exit` | | Leaves the VLAN configuration mode. | 13 |
| | `ip address` | `inband-default dhcp-bootp` | Sets the dynamic in-band IP address. | 13 |

**Table 86** Command Summary: config-vlan Commands (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | | `inband-default dhcp-bootp release` | Releases the dynamic in-band IP address. | 13 |
| | | `inband-default dhcp-bootp renew` | Updates the dynamic in-band IP address. | 13 |
| | | `inband-default <ip-address> <mask>` | Sets a static in-band IP address and subnet mask. | 13 |
| | | `<ip-address> <mask> manageable` | Sets the management IP address and subnet mask of the switch in the specified VLAN. | 13 |
| | | `<ip-address> <mask>` | Sets the IP address and subnet mask of the switch in the specified VLAN. | 13 |
| | | `default-gateway <ip-address>` | Sets a default gateway IP address for this VLAN. | 13 |

## 34.11.6 mvr Commands

The following table lists the `mvr` commands in configuration mode.

**Table 87** mvr Commands

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| `mvr <1-4094>` | | | Enters the MVR (Multicast VLAN Registration) configuration mode. | 13 |
| | `source-port <port-list>` | | Sets the source port(s).<br>An MVR source port can send and receive multicast traffic in a multicast VLAN. | 13 |
| | `receiver-port <port-list>` | | Sets the receiver port(s).<br>An MVR receiver port can only receive multicast traffic in a multicast VLAN. | 13 |
| | `inactive` | | Disables MVR settings. | 13 |
| | `mode <dynamic\|compatible>` | | Sets the MVR mode (`dynamic` or `compatible`). | 13 |
| | `name <name-str>` | | Sets the MVR name for identification purposes. | 13 |
| | `tagged <port-list>` | | Sets the port(s) to tag VLAN tags. | 13 |

**Table 87** mvr Commands (continued)

| COMMAND | | | DESCRIPTION | PRIVILEGE |
|---|---|---|---|---|
| | group <name-str> start-address <ip> end-address <ip> | | Sets the multicast group range for the MVR. | 13 |
| | exit | | Exist from the MVR configuration mode. | 13 |
| | 8021p-priority <0-7> | | Sets a priority level (0-7) to which the switch changes the priority in outgoing IGMP control packets. | 13 |
| | no source-port <port-list> | | Disables the source port(s).<br>An MVR source port can send and receive multicast traffic in a multicast VLAN. | 13 |
| | no receiver-port <port-list> | | Disables the receiver port(s).<br>An MVR receiver port can only receive multicast traffic in a multicast VLAN. | 13 |
| | no tagged <port-list> | | Sets the port(s) to untag VLAN tags. | 13 |
| | no inactive | | Enables MVR. | 13 |
| | no group | | Disables all MVR group settings. | 13 |
| | no group <name-str> | | Disables the specified MVR group setting. | 13 |

# CHAPTER 35
# User and Enable Mode Commands

This chapter describes some commands which you can perform in the User and Enable modes.

## 35.1 Overview

The following command examples show how you can use User and Enable modes to diagnose and manage your switch.

## 35.2 show Commands

These are the commonly used `show` commands.

### 35.2.1 show system-information

Syntax:

```
show system-information
```

This command shows the general system information (such as the firmware version and system up time).

An example is shown next.

```
ras# show system-info
System Name             : ES-3124
System Contact          :
System Location         :
Ethernet Address        : 00:13:49:6a:d1:87
ZyNOS F/W Version       : 3.70(TP.0)b0 | 4/28/2006
RomRasSize              : 2483368
System up Time          :     3:42:28 (145e1d ticks)
Bootbase Version        : V0.6 | 01/14/2005
```

## 35.2.2 show ip

Syntax:

```
show ip
```

This command displays the IP related information (such as IP address and subnet mask) on all switch interfaces.

The following figure shows the default interface settings.

```
ras> show  ip
Out-of-band Management IP Address = 192.168.0.1
Management IP Address
     IP[192.168.0.1], Netmask[255.255.255.0], VID[0]
IP Interface
     IP[192.168.1.1], Netmask[255.255.255.0], VID[1]
ras>
```

## 35.2.3 show logging

Syntax:

```
show logging
```

This command displays the system logs. The following figure shows an example.

```
ras# show logging
   1 Thu Jan  1 00:02:08 1970 PP05 -WARN  SNMP TRAP 3: link up
   2 Thu Jan  1 00:03:14 1970       INFO  adjtime task pause 1 day
   3 Thu Jan  1 00:03:16 1970 PP0f -WARN  SNMP TRAP 26: Event On Trap
   4 Thu Jan  1 00:03:16 1970 PINI -WARN  SNMP TRAP 1: warm start
   5 Thu Jan  1 00:03:16 1970 PINI -WARN  SNMP TRAP 3: link up
   6 Thu Jan  1 00:03:16 1970 PINI  INFO  main: init completed
   7 Thu Jan  1 00:00:13 1970 PP26  INFO  adjtime task pause 1 day
   8 Thu Jan  1 00:00:14 1970 PP0f -WARN  SNMP TRAP 26: Event On Trap
   9 Thu Jan  1 00:00:14 1970 PINI -WARN  SNMP TRAP 0: cold start
  10 Thu Jan  1 00:00:14 1970 PINI  INFO  main: init completed
  11 Thu Jan  1 00:00:04 1970 PP05 -WARN  SNMP TRAP 3: link up
  11 Thu Jan  1 00:00:04 1970 PP05 -WARN  SNMP TRAP 3: link up
Clear Error Log (y/n):
```

**Note:** If you clear a log (by entering `y` at the `Clear Error Log (y/n):` prompt), you cannot view it again.

## 35.2.4 show interface

Syntax:

```
show interface [port-number]
```

This command displays statistics of a port. The following example shows that port 2 is up and the related information.

```
ras# show interface 2
  Port Info     Port NO.                :2
                Link                    :100M/F
                Status                  :FORWARDING
                LACP                    :Disabled
                TxPkts                  :0
                RxPkts                  :63
                Errors                  :0
                Tx KBs/s                :0.0
                Rx KBs/s                :0.0
                Up Time                 :0:02:33
  TX Packet     Tx Packets              :0
                Multicast               :0
                Broadcast               :0
                Pause                   :0
                Tagged                  :0
  RX Packet     Rx Packets              :63
                Multicast               :0
                Broadcast               :63
                Pause                   :0
                Control                 :0
  TX Collison   Single                  :0
                Multiple                :0
                Excessive               :0
                Late                    :0
  Error Packet  RX CRC                  :0
                Length                  :0
                Runt                    :0
  Distribution  64                      :3
                65 to 127               :44
                128 to 255              :14
                256 to 511              :2
                512 to 1023             :0
                1024 to 1518            :0
                Giant                   :0
ras#
```

## 35.2.5 show mac address-table

Syntax:

```
show mac address-table <all <sort>|static>
```

Where

<sort> = Specifies the sorting criteria (MAC, VID or port).

This command displays the MAC address(es) stored in the switch. The following example shows the static MAC address table.

```
ras# show mac address-table static
Port      VLAN ID        MAC Address         Type
CPU       1              00:a0:c5:01:23:46   Static
ras#
```

## 35.3 ping

Syntax:

```
ping <ip|host-name> < [in-band|out-of-band|vlan <vlan-id> ] [
size <0-1472> ] [ -t ]>
```

where

| | | |
|---|---|---|
| `<ip\|host-name>` | = | The IP address or host name of an Ethernet device. |
| `[in-band\|out-of-band\|vlan <vlan-id> ]` | = | Specifies the network interface or the VLAN ID to which the Ethernet device belongs. `out-of-band` refers to the management port while `in-band` means the other ports on the switch. |
| `[ size <0-1472> ]` | = | Specifies the packet size to send. |
| `[ -t ]` | = | Sends Ping packets to the Ethernet device indefinitely. Press `[CTRL]+ C` to terminate the Ping process. |

This command sends Ping packets to an Ethernet device. The following example sends Ping requests to and displays the replies from an Ethernet device with an IP address of `192.168.1.100`.

```
ras# ping 192.168.1.100
 sent  rcvd  rate    rtt     avg    mdev     max     min  reply from
    1     1  100       0       0       0       0       0  192.168.1.100
    2     2  100       0       0       0       0       0  192.168.1.100
    3     3  100       0       0       0       0       0  192.168.1.100
ras#
```

## 35.4 traceroute

Syntax:

```
traceroute <ip|host-name> [in-band|out-of-band|vlan <vlan-
id>][ttl <1-255>] [wait <1-60>] [queries <1-10>]
```

where

| | | |
|---|---|---|
| `<ip\|host-name>` | = | The IP address or host name of an Ethernet device. |
| `[in-band\|out-of-band\|vlan <vlan-id> ]` | = | Specifies the network interface or the VLAN ID to which the Ethernet device belongs. |
| `[ttl <1-255>]` | = | Specifies the Time To Live (TTL) period. |
| `[wait <1-60>]` | = | Specifies the time period to wait. |
| `[queries <1-10>]` | = | Specifies how many tries the switch performs the traceroute function. |

This command displays information about the route to an Ethernet device. The following example displays route information to an Ethernet device with an IP address of `192.168.1.100`.

```
ras> traceroute 192.168.1.100
traceroute to 192.168.1.100, 30 hops max, 40 byte packet
  1:192.168.1.100 (10 ms) (10 ms) (0 ms)
traceroute done:
ras>
```

## 35.5 Copy Port Attributes

Use the `copy running-config` command to copy attributes of one port to another port or ports.

Syntax:

```
copy running-config interface port-channel <port> <port-
list>
copy running-config interface port-channel <port> <port-
list> [active] [name] [speed-duplex] [bpdu-control] [flow-
control] [intrusion-lock] [vlan1q] [vlan1q-member] [bandwidth-
limit] [vlan-stacking] [port-security] [broadcast-storm-
control] [mirroring] [port-access-authenticator] [queuing-
method] [igmp-filtering] [spanning-tree] [mrstp] [protocol-
based-vlan] [port-based-vlan]
```

where

| | | |
|---|---|---|
| `copy running-config interface port-channel <port> <port-list>` | = | Copies all of the possible attributes from one port to another port or ports. |
| `copy running-config interface port-channel from <port> to <port-list> [active ... ]` | = | Copies only the specified port attributes from one port to another port or ports. |

An example is shown next.

- Copy all attributes of port 1 to port 2
- Copy selected attributes (active, bandwidth limit and STP settings) to ports 5-10

```
ras# copy running-config interface port-channel 1 2
ras# copy running-config interface port-channel 1 5-10 active bandwidth-
limit spanning-tree
```

# 35.6 Configuration File Maintenance

The following sections shows how to manage the configuration files.

## 35.6.1 Using a Different Configuration File

You can store up to two configuration files on the switch. Only one configuration file is used at a time. By default the switch uses the first configuration file (with an index number of 1). You can set the switch to use a different configuration file. There are two ways in which you can set the switch to use a different configuration file: restart the switch (cold reboot) and restart the system (warm reboot).

Use the `boot config` command to restart the switch and use a different configuration file (if specified). The following example restarts the switch to use the second configuration file.

```
ras# boot config 2
```

Use the `reload config` command to restart the system and use a different configuration file (if specified). The following example restarts the system to use the second configuration file.

```
ras# reload config 2
```

**Note:** When you use the `write memory` command without specifying a configuration file index number, the switch saves the changes to the configuration file the switch is currently using.

## 35.6.2 Resetting to the Factory Default

Follow the steps below to reset the switch back to the factory defaults.

1. Enter `erase running config` to reset the current running configuration.
2. Enter `write memory` to save the changes to the current configuration file. If you want to reset the second configuration file, use the `write memory` command again with the specified index number.

The following example resets both configuration files to the factory default settings.

```
ras# erase running-config
ras# write memory
ras# write memory 2
```

# CHAPTER 36
# Configuration Mode Commands

This chapter describes how to enable and configure your switch's features using commands. For more background information, see the feature specific chapters which proceed the commands chapters.

## 36.1 Enabling IGMP Snooping

To enable IGMP snooping on the switch. Enter `igmp-snooping` and press [ENTER]. You can also set how to treat traffic from an unknown multicast group by typing the `unknown-multicast-frame` parameter.

Syntax:

```
igmp-snooping
igmp-snooping host-timeout <1-16711450>
igmp-snooping leave-timeout <1-16711450>
igmp-snooping unknown-multicast-frame <drop|flooding>
igmp-snooping reserved-multicast-group <drop|flooding>
```

where

| | | |
|---|---|---|
| `igmp-snooping` | = | Enables IGMP snooping on the switch. |
| `host-timeout <1-16711450>` | = | Specifies the time out period of the switch with respect to IGMP report queries. If an IGMP report for a multicast group was not received for a host-timeout period, from a specific port, this port is deleted from the member list of that multicast group. |
| `leave-timeout <1-16711450>` | = | Specifies the time that the switch will wait for multicast members to respond to a leave report. If no response happens in the timeout period, the switch deletes the port from the multicast group. |
| `unknown-multicast-frame <drop\|flooding>` | = | Specifies whether you want to discard packets from unknown multicast groups or whether you want to forward them to all ports. |
| `reserved-multicast-group <drop\|flooding>` | = | Specifies whether you want to discard packets in the reserved multicast groups or whether you want to forward them to all ports. |

An example is shown next.

- Enable IGMP snooping on the switch.
- Set the `host-timeout` and `leave-timeout` values to 30 seconds
- Set the switch to drop packets from unknown multicast groups.

```
ras(config)# igmp-snooping
ras(config)# igmp-snooping host-timeout 30
ras(config)# igmp-snooping leave-timeout 30
ras(config)# igmp-snooping unknown-multicast-frame drop
```

## 36.2 Configure IGMP Filter

Use the following commands in the config mode to configure IGMP filtering profiles.

Syntax:

```
igmp-filtering
igmp-filtering profile <name> start-address <ip> end-address
<ip>
```

where

| | | |
|---|---|---|
| `igmp filtering` | = | Enables IGMP filtering on the switch |
| `profile <name>` | = | Specifies a name (up to 32 alphanumeric characters) for this IGMP profile. If you want to edit an existing IGMP profile enter the existing profile name followed by `start-address` and `end-address` parameters. |
| `start-address` | = | Specifies the starting multicast IP address for a range of multicast IP addresses that you want to belong to the IGMP filter profile. IP address in the range 224.0.0.0 to 239.255.255.255 are used for IP multicasting. |
| `end-address` | = | Specifies the ending multicast IP address for a range of multicast IP addresses that you want to belong to the IGMP filter profile. IP address in the range 224.0.0.0 to 239.255.255.255 are used for IP multicasting. |

An example is shown next.

- Enable IGMP filtering on the switch.
- Create an IGMP filtering profile **filter1** and specify the multicast IP addresses in the range **224.255.255.0** to **225.255.255.255** to belong to this profile.

```
ras(config)# igmp-filtering
ras(config)# igmp-filtering profile filter1 start-address 224.255.255.0
end-address 225.255.255.255
```

## 36.3 Enabling STP

Use the `spanning-tree` or the `mrstp` commands to enable and configure STP on the switch. The difference between the commands is that `spanning-tree` only allows you to set up one spanning tree configuration and the `mrstp` command allows you to set up multiple ones.

Syntax:

```
spanning-tree
spanning-tree priority <0-61440>
spanning-tree hello-time <1-10> maximum-age <6-40> forward-
delay <4-30>
spanning-tree <port-list> path-cost <1-65535>
spanning-tree <port-list> priority <0-255>
```

and

```
mrstp <treeIndex> <cr>
mrstp <treeIndex> priority <0-61440>
mrstp <treeIndex> hello-time <1-10> maximum-age <6-40> forward-
delay <4-30>
mrstp interface <port-list> <cr>
mrstp interface <port-list> path-cost <1-65535>
mrstp interface <port-list> priority <0-255>
mrstp interface <port-list> treeIndex <1-2>
```

where

| | | |
|---|---|---|
| `spanning-tree` | = | Enables STP on the switch. |
| `mrstp <treeIndex>` | | Enables a specific tree configuration. |
| `priority <0-61440>` | = | Specifies the bridge priority for the switch. The lower the numeric value you assign, the higher the priority for this bridge.<br><br>Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch.<br><br>Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay. |
| `hello-time <1-10>` | = | Specifies the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. |

| | | |
|---|---|---|
| `maximum-age <6-40>` | = | Specifies the maximum time (in seconds) a switch can wait without receiving a BPDU before attempting to reconfigure. All switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the switch ports attached to the network. |
| `forward-delay <4-30>` | = | Specifies the maximum time (in seconds) a switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. |
| `<port-list> path-cost <1-65535>` | = | Enables STP on the specified ports.<br><br>Specifies the the cost of transmitting a frame on to a LAN through that port. It is assigned according to the speed of the bridge. |
| `<port-list> priority <0-255>` | = | Specifies the priority for each port.<br><br>Priority decides which port should be disabled when more than one port forms a loop in a switch. Ports with a higher priority numeric value are disabled first. |
| `<port-list> treeIndex <1-2>` | = | Specifies which STP configuration these ports will participate in. (`mrstp` command only). |

An example using `spanning-tree` command is shown next.

- Enable STP on the switch.
- Set the bridge priority of the switch to 0.
- Set the Hello Time to 4, Maximum Age to 20 and Forward Delay to 15 on the switch.
- Enable STP on port 10 with a path cost of 150.
- Set the priority for port 10 to 20.

```
ras(config)# spanning-tree priority 0
ras(config)# spanning-tree hello-time 4 maximum-age 20 forward-delay 15
ras(config)# spanning-tree 10 path-cost 150
ras(config)# spanning-tree 10 priority 20
```

# 36.4 no Command Examples

These are the commonly used command examples that belong to the `no` group of commands. The `no` group commands are commands which are preceded by keyword `no`. This command negates the intended action of the command. In most cases the `no` command disables, resets or clears settings. There are cases, however, where the `no` command can activate features. This section shows some uses of these commands.

## 36.4.1 Disable Commands

Use the `no` command to disable features on the switch.

Syntax:

```
no spanning-tree
no mirror-port
```

Disables STP on the switch.

Disables port mirroring on the switch.

## 36.4.2 Resetting Commands

Use the `no` command to reset switch settings to their default values.

Syntax:

```
no https timeout
```

Resets the https session timeout to default.

An example is shown next. The session timeout is reset to 300 seconds.

```
ras(config)# no https timeout
  Cache timeout 300
```

## 36.4.3 Re-enable commands

The no command can also be used to re-enable features which have been disabled.

Syntax:

```
no ip route <ip> <mask> inactive
```

where

`<ip> <mask> inactive` = Re-enables an ip route with the specified IP address and subnet mask.

An example is shown next.

- Enable the IP route with the IP address of 192.168.11.1 and subnet mask of 255.255.255.0. This ip route must have already been created and made inactive prior to re-enable command being applied.

```
ras(config)# no ip route 192.168.11.1 255.255.255.0 inactive
```

## 36.4.4 Other Examples of no Commands

In some cases the `no` command can disable a feature, disable an option of a feature or disable a feature on a port by port basis.

### 36.4.4.1 no trunk

Syntax:

```
no trunk <T1|T2|T3|T4|T5|T6>
no trunk <T1|T2|T3|T4|T5|T6> lacp
no trunk <T1|T2|T3|T4|T5|T6> interface <port-list>
```

where

`<T1|T2|T3|T4|T5|T6>` = Disables the trunk group.

`<T1|T2|T3|T4|T5|T6> lacp` = Disables LACP in the trunk group.

`<T1|T2|T3|T4|T5|T6> interface <port-list>` = Removes ports from the trunk group.

An example is shown next.

- Disable trunk one (T1).
- Disable LAPC on trunk three (T3).
- Remove ports one, three, four and five from trunk two (T2).

```
ras(config)# no trunk T1
ras(config)# no trunk T3 lacp
ras(config)# no trunk T2 interface 1,3-5
```

### 36.4.4.2 no port-access-authenticator

Syntax:

```
no port-access-authenticator
no port-access-authenticator <port-list> reauthenticate
no port-access-authenticator <port-list>
```

where

| | | |
|---|---|---|
| | = | Disables port authentication on the switch. |
| `<port-list> reauthenticate` | = | Disables the re-authentication mechanism on the listed port(s). |
| `<port-list>` | = | Disables authentication on the listed ports. |

An example is shown next.

- Disable authentication on the switch.
- Disable re-authentication on ports one, three, four and five.
- Disable authentication on ports one, six and seven.

**Figure 116** no port-access-authenticator Command Example

```
ras(config)# no port-access-authenticator
ras(config)# no port-access-authenticator 1,3-5 reauthenticate
ras(config)# no port-access-authenticator 1,6-7
```

### 36.4.4.3 no ssh

Syntax:

```
no ssh key <rsa1|rsa|dsa>
no ssh known-hosts <host-ip>
no ssh known-hosts <host-ip> [1024|ssh-rsa|ssh-dsa]
```

where

| | | |
|---|---|---|
| `key <rsa1\|rsa\|dsa>` | = | Disables the secure shell server encryption key. Your switch supports SSH versions 1 and 2 using RSA and DSA authentication. |
| `known-hosts <host-ip>` | = | Removes a specific remote host from the list of all known hosts. |
| `known-hosts <host-ip> [1024\|ssh-rsa\|ssh-dsa]` | = | Removes remote known hosts with a specified public key type (1024-bit RSA1, RSA or DSA). |

An example is shown next.

- Disable the secure shell RSA1 encryption key.
- Remove the remote host with IP address 172.165.1.8 from the list of known hosts.
- Remove the remote host with IP address 172.165.1.9 and with an SSH-RSA encryption key from the list of known hosts.

```
ras(config)# no ssh key rsa1
ras(config)# no ssh known-hosts 172.165.1.8
ras(config)# no ssh known-hosts 172.165.1.9 ssh-rsa
```

## 36.5 Queuing Method Commands

You can use the queuing method commands to configure queuing for outgoing traffic on the switch. You can only select one queuing method for the switch.

Syntax:

```
spq

wfq

wrr
wrr fe-spq <Q0-Q7>
```

where

| | | |
|---|---|---|
| `spq` | = | Sets the queuing method to SPQ (Strictly Priority Queuing). |
| `wfq` | = | Sets the queuing method to WFQ (Weighted Fair Queuing). |
| `wrr` | = | Sets the queuing method to WRR (Weighted Round Robin). |
| `wrr fe-spq <Q0-Q7>` | = | Sets the switch to use SPQ to service the subsequent queue(s) after and including the specified queue.<br><br>You may want to configure weights for specific queues on the ports if you use WRR. See the weight command example in Section 37.2.9 on page 293. |

An example is shown next.

- Set the queueing method to SPQ.

```
ras(config)# spq
```

## 36.6 Static Route Commands

You can create and configure static routes on the switch by using the `ip route` command.

Syntax:

```
ip route <ip> <mask> <next-hop-ip>
ip route <ip> <mask> <next-hop-ip> [metric <metric>][name
<name>] [inactive]
```

where

| | | |
|---|---|---|
| `<ip>` | = | Specifies the network IP address of the final destination. |
| `<mask>` | = | Specifies the subnet mask of this destination. |
| `<next-hop-ip>` | = | Specifies the IP address of the gateway. The gateway is an immediate neighbor of your switch that will forward the packet to the destination. The gateway must be a router on the same segment as your switch. |
| `[metric <metric>]` | = | The metric represents the "cost" of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. Enter a number that approximates the cost for this link. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number. |
| `[name <name>]` | = | Specifies a descriptive name (up to 32 printable ASCII characters) for identification purposes. |
| `[inactive]` | = | Deactivates a static route |

An example is shown next.

- Create a static route with the destination IP address of 172.21.1.104, subnet mask of 255.255.0.0 and the gateway IP address of 192.168.1.2.
- Assigns a metric value of 2 to the static route.
- Assigns the name "route1" to the static route.

```
ras(config)# ip route 172.21.1.104 255.255.0.0 192.168.1.2
ras(config)# ip route 172.21.1.104 255.255.0.0 192.168.1.2 metric 2
ras(config)# ip route 172.21.1.104 255.255.0.0 192.168.1.2 name route1
```

## 36.7 Enabling MAC Filtering

You can create a filter to drop packets based on the MAC address of the source or the destination.

Syntax:

```
mac-filter name <name> mac <mac-addr> vlan <vlan-id> drop <src/
dst/both>
```

where

| | | |
|---|---|---|
| `name <name>` | = | Names the filtering rule. |
| `mac <mac-addr>` | = | Specifies the MAC address you want to filter. |
| `vlan <vlan-id>` | = | Specifies which VLAN this rule applies to. |
| `drop <src/dst/both>` | = | Selects the behavior of the rule.<br>• src - drop packets coming from the specified MAC address<br>• dst- drop packets going to the specified MAC address<br>• both - drop packets coming from or going to the specified MAC address |

An example is shown next.

- Create a filtering rule called "filter1".
- Drop packets coming from and going to MAC address 00:12:00:12:00:12 on VLAN.

```
ras(config)# mac-filter name filter 1
ras(config)# mac-filter name filter 1 mac 00:12:00:12:00:12 vlan 1 drop both
```

## 36.8 Enabling Trunking

To create and enable a trunk, enter `trunk` followed by the ports which you want to group and press [ENTER].

Syntax:

```
trunk <T1|T2|T3|T4|T5|T6>
trunk <T1|T2|T3|T4|T5|T6> interface <port-list>
trunk <T1|T2|T3|T4|T5|T6> lacp
```

where

| | | |
|---|---|---|
| `<T1\|T2\|T3\|T4\|T5\|T6>` | = | Enables the trunk. |
| `<T1\|T2\|T3\|T4\|T5\|T6> interface <port-list>` | = | Places ports in the trunk. |
| `<T1\|T2\|T3\|T4\|T5\|T6> lacp` | = | Enables LACP in the trunk. |

An example is shown next.

- Create trunk 1 on the switch.

- Place ports 5-10 in trunk 1.
- Enable dynamic link aggregation (LACP) on trunk 1.

```
ras(config)# trunk t1
ras(config)# trunk t1 interface 5-10
ras(config)# trunk t1 lacp
```

# 36.9 Enabling Port Authentication

To enable a port authentication, you need to specify your RADIUS server details and select the ports which require external authentication. You can set up multiple RADIUS servers and specify how the switch will process authentication requests.

## 36.9.1 RADIUS Server Settings

Configuring multiple RADIUS servers is only available via the command interpreter mode. Use the `radius-server` command to set up your RADIUS server settings.

Syntax:

```
radius-server host <index> <ip>
radius-server host <index> <ip> [acct-port <socket-number>] [key
<key-string>]
radius-server timeout <1-1000>
radius-server mode <priority|round-robin>
```

where

| | | |
|---|---|---|
| `radius-server host <index> <ip>` | = | Specifies the IP address of the RADIUS server. |
| `[acct-port <socket-number>]` | = | Changes the UDP port of the RADIUS server from the default (1812). |
| `[key <key-string>]` | = | Specifies a password (up to 32 alphanumeric characters) as the key to be shared between the RADIUS server and the switch. |

| | | |
|---|---|---|
| `radius-server timeout <1-1000>` | = | Specifies the timout period (in seconds) the switch will wait for a response from a RADIUS server. If 2 RADIUS servers are configured, this is the total time the switch will wait for a response from either server. |
| `mode <priority\|round-robin>` | = | Specifies the way the switch will process requests from the clients to the RADIUS server. (Only applicable with multiple RADIUS servers configured.)<br><br>`priority` - When a client sends an authentication request through the switch to the RADIUS server. The switch will forward the request to the RADIUS server. If no response within half the timeout period, it will forward the request to the second RADIUS server.<br><br>`round-robin` - When a client sends an authentication request through the switch to the RADIUS server. The switch will forward the request to the first RADIUS server. If there is no response within the timeout period, the request times out. The client sends an authentication request again and the switch forwards the request to the second RADIUS server. |

See Section 36.9.2 on page 286 for an example.

## 36.9.2 Port Authentication Settings

Use the `port-access-authenticator` command to configure port security on the switch.

Syntax:

```
port-access-authenticator
port-access-authenticator <port-list>
port-access-authenticator <port-list> reauthenticate
port-access-authenticator <port-list> reauth-period <reauth-period>
```

where

| | | |
|---|---|---|
| `port-access-authenticator` | = | Enables port authentication on the switch. |
| `port-access-authenticator <port-list>` | = | Specifes which ports require authentication. |
| `reauthenticate` | = | Enables reauthentication on the port. |
| `reauth-period <reauth-period>` | = | Specifies how often a client has to re-enter his or her username and password to stay connected to the port. |

An example is shown next.

- Specify RADIUS server 1 with IP address 10.10.10.1, port 1890 and the string secretKey as the password. See Section 36.9.1 on page 285 for more information on RADIUS server commands.
- Specify the timeout period of 30 seconds that the switch will wait for a response from the RADIUS server.
- Enable port authentication on ports 4 to12.
- Activate reauthentication on the ports.
- Specify 1800 seconds as the interval for client reauthentication.

```
ras(config)# radius-server host 1 10.10.10.1 acct-port 1890 key secretKey
ras(config)# radius-server timeout 30
ras(config)# port-access-authenticator
ras(config)# port-access-authenticator 4-12
ras(config)# port-access-authenticator 4-12 reauthenticate
ras(config)# port-access-authenticator 4-12 reauth-period 1800
```

# CHAPTER 37
# Interface Commands

These are some commonly used configuration commands that belong to the `interface` group of commands.

## 37.1 Overview

The interface commands allow you to configure the switch on a port by port basis.

## 37.2 Interface Command Examples

This section provides examples of some frequently used interface commands.

### 37.2.1 interface port-channel

Use this command to enable the specified ports for configuration. Indicate multiple, non-sequential ports separated by a comma. Use a dash to specify a port range.

Syntax:

```
interface port-channel <port-list>
```

An example is shown next.

- Enter the configuration mode.
- Enable ports 1, 3, 4 and 5 for configuration.
- Begin configuring for those ports.

```
ras# config
ras(config)# interface port-channel 1,3-5
ras(config-interface)#
```

### 37.2.2 bpdu-control

Syntax:

```
bpdu-control <peer|tunnel|discard|network>
```

where

| | | |
|---|---|---|
| <peer\|tunnel\|discard\| network> | = | Type peer to process any BPDUs received on these ports.<br>Type tunnel to forward BPDUs received on these ports.<br>Type discard to drop any BPDUs received on these ports.<br>Type network to process a BPDU with no VLAN tag and forward a tagged BPDU. |

An example is shown next.

- Enable ports 1, 3, 4 and 5 for configuration.
- Set the BPDU control to tunnel, to forward BPDUs received on ports one, three, four and five.

```
ras(config)# interface port-channel 1,3-5
ras(config-interface)# bpdu-control tunnel
ras(config-interface)#
```

## 37.2.3 broadcast-limit

Syntax:

```
broadcast-limit
broadcast-limit <pkt/s>
```

where

| | | |
|---|---|---|
| | = | Enables broadcast storm control limit on the switch. |
| <pkt/s> | = | Limits how many broadcast packet the interface receives per second. |

An example is shown next.

- Enable port one for configuration.
- Enable broadcast control.
- Set how many broadband packets the interface receives per second.

```
ras(config)# interface port-channel 1
ras(config-interface)# broadcast-limit
ras(config-interface)# broadcast-limit 21
```

## 37.2.4 bandwidth-limit

The bandwidth-limit command enables bandwidth control on the switch.

Syntax:

```
bandwidth-limit
bandwidth-limit pir <Kbps>
bandwidth-limit cir <Kbps>
bandwidth-limit egress <Kbps>
```

where

| | | |
|---|---|---|
| `pir <Kbps>` | = | Sets the maximum bandwidth allowed for incoming traffic. |
| `cir <Kbps>` | = | Sets the guaranteed bandwidth allowed for incoming traffic. |
| `egress <Kbps>` | = | Sets the maximum bandwidth allowed for outgoing traffic (`egress`) on the switch. |

An example is shown next.

- Enable port one for configuration.
- Enable bandwidth control.
- Set the outgoing traffic bandwidth limit to 5000Kbps.
- Set the guaranteed bandwidth allowed for incoming traffic to 4000Kbps.
- Set the maximum bandwidth allowed for incoming traffic to 8000Kbps.

```
ras(config)# interface port-channel 1
ras(config-interface)# bandwidth-limit
ras(config-interface)# bandwidth-limit egress 5000
ras(config-interface)# bandwidth-limit cir 4000
ras(config-interface)# bandwidth-limit pir 8000
```

## 37.2.5 mirror

The `mirror` command enables port mirroring on the interface.

Syntax:

```
mirror
mirror dir <ingress|egress|both>
```

where

| | | |
|---|---|---|
| `dir <ingress\|egress\|both>` | = | Enables port mirroring for incoming, outgoing or both incoming and outgoing traffic.<br><br>Port mirroring copies traffic from one or all ports to another or all ports for external analysis. |

An example is shown next.

- Enable port mirroring.
- Enable the monitor port 3.
- Enable ports 1, 4, 5 and 6 for configuration.
- Enable port mirroring on the ports.
- Enable port mirroring for outgoing traffic. Traffic is copied from ports 1, 4, 5 and 6 to port three in order to examine it in more detail without interfering with the traffic flow on the original ports.

```
ras(config)# mirror-port
ras(config)# mirror-port 3
ras(config)# interface port-channel 1,4-6
ras(config-interface)# mirror
ras(config-interface)# mirror dir egress
```

## 37.2.6 gvrp

Syntax:

```
gvrp
```

GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network. Enable this function to permit VLAN groups beyond the local switch.

An example is shown next.

- Enable the IEEE 802.1Q tagged VLAN command to configure tagged VLAN for the switch.
- Enable ports one, three, four and five for configuration.
- Enable GVRP on the interface.

```
ras(config)# vlan1q gvrp
ras(config)# interface port-channel 1,3-5
ras(config-interface)# gvrp
```

## 37.2.7 ingress-check

The `ingress-check` command enables the device to discard incoming frames for VLANs that do not have this port as a member.

Syntax:

```
ingress-check
```

An example is shown next.

- Enable ports 1, 3, 4 and 5 for configuration.

- Enable ingress checking on the interface.

```
ras(config)# interface port-channel 1,3-5
ras(config-interface)# ingress-check
```

## 37.2.8 frame-type

Syntax:

```
frame-type <all|tagged|untagged>
```

where

| | |
|---|---|
| `<all\|tagged\|untagged>` = | Choose to accept both tagged and untagged incoming frames, just tagged incoming frames or just untagged incoming frames on a port. |

An example is shown next.

- Enable ports one, three, four and five for configuration.
- Enable ingress checking on the ports.
- Enable tagged frame-types on the interface.

```
ras(config)# interface port-channel 1,3-5
ras(config-interface)# ingress-check
ras(config-interface)# frame-type tagged
```

## 37.2.9 weight

Syntax:

```
weight <wt1> <wt2> ... <wt8>
```

where

| | |
|---|---|
| `<wt1> <wt2> ... <wt8>` = | Sets the interface WFQ weighting. A weight value of one to eight is given to each variable from `wt 1` to `wt 8`. |

An example is shown next.

- Enable WFQ queuing on the switch.
- Enable port two and ports six to twelve for configuration.

- Set the queue weights from Q0 to Q7.

```
ras# configure
ras(config)# wfq
ras(config)# interface port-channel 2,6-12
ras(config-interface)# weight 8 7 6 5 4 3 2 1
```

## 37.2.10 egress set

Syntax:

```
egress set <port-list>
```

where

`<port-list>` = Sets the outgoing traffic port list for a port-based VLAN.

An example is shown next.

- Enable port-based VLAN tagging on the switch.
- Enable ports one, three, four and five for configuration.
- Set the outgoing traffic ports as the CPU (0), seven (7), eight (8) and nine (9).

```
ras(config)# vlan-type port-based
ras(config)# interface port-channel 1,3-5
ras(config-interface)# egress set 0,7-9
```

## 37.2.11 qos priority

Syntax:

```
qos priority <0 .. 7>
```

where

`<0 .. 7>` = Sets the quality of service priority for a port.

An example is shown next.

- Enable ports one, three, four and five for configuration.
- Set the IEEE 802.1p quality of service priority as four (4).

```
ras(config)# interface port-channel 1,3-5
ras(config-interface)# qos priority 4
```

## 37.2.12 name

Syntax:

```
name <port-name-string>
```

where

`<port-name-string>` = Sets a name for your port interface(s).

An example is shown next.

- Enable ports one, three, four and five for configuration.
- Set a name for the ports.

```
ras(config)# interface port-channel 1,3-5
ras(config-interface)# name Test
```

## 37.2.13 speed-duplex

Syntax:

```
speed-duplex <auto|10-half|10-full|100-half|100-full|1000-full>
```

where

`<auto|10-half|10-full|100-half|100-full|1000-full>` = Sets the duplex mode (half or full) and speed (10, 100 or 1000 Mbps) of the connection on the port. Selecting auto (auto-negotiation) makes one port able to negotiate with a peer automatically to obtain the connection speed and duplex mode that both ends support.

An example is shown next.

- Enable ports one, three, four and five for configuration.
- Set the speed to 100 Mbps in half duplex mode.

```
ras(config)# interface port-channel 1,3-5
ras(config-interface)# speed-duplex 100-half
```

## 37.2.14 test

You can perform an interface loopback test on specified ports. The test returns `Passed!` or `Failed!`

An example is shown next.

- Select ports 33-36 for internal loopback test.
- Execute the test command.
- View the results.

```
ras(config)# interface port-channel 33-44
ras(config-interface)# test 33-36
Testing internal loopback on port 33 :Passed!
  Ethernet Port 33 Test ok.
Testing internal loopback on port 34 :Passed!
  Ethernet Port 34 Test ok.
Testing internal loopback on port 35 :Passed!
  Ethernet Port 35 Test ok.
Testing internal loopback on port 36 :Passed!
  Ethernet Port 36 Test ok.
```

# 37.3 Interface no Command Examples

Similar to the no commands in the Enable and Config modes, the no commands for the Interface sub mode also disable certain features. In this mode, however, this takes place on a port by port basis.

## 37.3.1 no bandwidth-limit

You can disable bandwidth limit on port 1 simply by placing the `no` command in front of the `bandwidth-limit` command.

Syntax:

```
no bandwidth-limit
```

An example is shown next:

- Disable bandwidth limit on port1

```
ras(config)# interface port-channel 1
ras(config-interface)# no bandwidth-limit
```

# CHAPTER 38
# IEEE 802.1Q Tagged VLAN Commands

This chapter describes the IEEE 802.1Q Tagged VLAN and associated commands.

## 38.1 Configuring Tagged VLAN

The following procedure shows you how to configure tagged VLAN.

**1** Use the IEEE 802.1Q tagged VLAN commands to configure tagged VLAN for the switch.

- Use the `vlan <vlan-id>` command to configure or create a VLAN on the switch. The switch automatically enters the `config-vlan` mode.Use the `inactive` command to deactivate the VLAN(s).
- Use the `interface port-channel <port-list> command` to enter the config-interface mode to set the VLAN settings on a port, then use the `pvid <vlan-id>` command to set the VLAN ID you created for the port-list to that specific port in the PVID table.
- Use the `exit` command when you are finished configuring the VLAN.

```
ras (config)# vlan 2000
ras (config-vlan)# name up1
ras (config-vlan)# fixed 10-12
ras (config-vlan)# no untagged 10-12
ras (config-vlan)# exit
ras (config)# interface port-channel 10-12
ras (config-interface)# pvid 2000
ras (config-interface)# exit
```

**2** Configure your management VLAN.

- Use the `vlan <vlan-id>` command to create a VLAN (VID 3 in this example) for managing the switch, and the switch will activate the new management VLAN.
- Use the `inactive` command to disable the new management VLAN.

```
ras (config)# vlan 3
ras (config-vlan)# inactive
```

# 38.2 Global VLAN1Q Tagged VLAN Configuration Commands

This section shows you how to configure and monitor the IEEE 802.1Q Tagged VLAN.

## 38.2.1 GARP Status

Syntax:

```
show garp
```

This command shows the switch's GARP timer settings, including the join, leave and leave all timers.

An example is shown next.

```
ras # show garp
GARP Timer
------------------------
Join Timer = 200
Leave Timer = 600
Leave All Timer = 10000
ras#
```

## 38.2.2 GARP Timer

Syntax:

```
garp join <msec> leave <msec> leaveall <msec>
```

where

| | | |
|---|---|---|
| `join <msec>` | = | This sets the duration of the Join Period timer for GVRP in milliseconds. Each port has a Join Period timer. The allowed Join Time range is between 100 and 32767 milliseconds; the default is 200 milliseconds. |
| `leave <msec>` | = | This sets the duration of the Leave Period timer for GVRP in milliseconds. Each port has a single Leave Period timer. Leave Time must be two times larger than Join Timer; the default is 600 milliseconds. |
| `leaveall <msec>` | = | This sets the duration of the Leave All Period timer for GVRP in milliseconds. Each port has a single Leave All Period timer. Leave All Timer must be larger than Leave Timer; the default is 10000 milliseconds. |

This command sets the switch's GARP timer settings, including the join, leave and leave all timers.

Switches join VLANs by making a declaration. A declaration is made by issuing a Join message using GARP. Declarations are withdrawn by issuing a Leave message. A Leave All message terminates all registrations. GARP timers set declaration timeout values.

The following example sets the Join Timer to 300 milliseconds, the Leave Timer to 800 milliseconds and the Leave All Timer to 11000 milliseconds.

```
ras (config)# garp join 300 leave 800 leaveall 11000
```

### 38.2.3 GVRP Timer

Syntax:

```
show vlan1q gvrp
```

This command shows the switch's GVRP settings.

An example is shown next.

```
ras # show vlan1q gvrp
GVRP Support
---------------------
gvrpEnable = YES
ras #
```

### 38.2.4 Enable GVRP

Syntax:

```
vlan1q gvrp
```

This command turns on GVRP in order to propagate VLAN information beyond the switch.

### 38.2.5 Disable GVRP

Syntax:

```
no vlan1q gvrp
```

This command turns off GVRP so that the switch does not propagate VLAN information to other switches.

## 38.3 Port VLAN Commands

You must configure the switch port VLAN settings in config-interface mode.

### 38.3.1 Set Port VID

Syntax:

```
pvid <VID>
```

where

`<VID>` = Specifies the VLAN number between 1 and 4094.

This command sets the default VLAN ID on the port(s).

The following example sets the default VID to 200 on ports 1 to 5.

```
ras (config)# interface port-channel 1-5
ras (config-interface)# pvid 200
```

### 38.3.2 Set Acceptable Frame Type

Syntax:

```
frame-type <all|tagged|untagged>
```

where

`<all|tagged|untagged>` = Specifies all Ethernet frames (tagged and untagged), only tagged Ethernet frames or only untagged Ethernet frames.

This command sets the specified port to accept all Ethernet frames or only those with an IEEE 802.1Q VLAN tag.

The following example sets ports 1 to 5 to accept only tagged frames.

```
ras (config)# interface port-channel 1-5
ras (config-interface)# frame-type tagged
```

### 38.3.3 Enable or Disable Port GVRP

Use the `gvrp` command to enable GVRP on the port(s). Use the `no gvrp` command to disable GVRP.

The following example turns off GVRP for ports 1 to 5.

```
ras (config)# interface port-channel 1-5
ras (config-interface)# no gvrp
```

## 38.3.4 Modify Static VLAN

Use the following commands in the config-vlan mode to configure the static VLAN table.

Syntax:

```
vlan <vlan-id>
fixed <port-list>
forbidden <port-list>
name <name-str>
normal <port-list>
untagged <port-list>
no fixed <port-list>
no forbidden <port-list>
no untagged <port-list>
```

where

| | | |
|---|---|---|
| `<vlan-id>` | = | The VLAN ID [1 – 4094]. |
| `<name-str>` | = | A name to identify the SVLAN entry. |
| `<port-list>` | = | This is the switch port list. |

- Enter `fixed` to register the `<port-list>` to the static VLAN table with `<vlan-id>`.
- Enter `normal` to confirm registration of the `<port-list>` to the static VLAN table with `<vlan-id>`.
- Enter `forbidden` to block a `<port-list>` from joining the static VLAN table with `<vlan-id>`.
- Enter `no fixed` or `no forbidden` to change `<port-list>` to normal status.
- Enter `untagged` to send outgoing frames without a tag.
- Enter `no untagged` to tag outgoing frames.

### 38.3.4.1 Modify a Static VLAN Table Example

The following example configures ports 1 to 5 as fixed and untagged ports in VLAN 2000.

```
ras (config)# vlan 2000
ras (config-vlan)# fixed 1-5
ras (config-vlan)# untagged 1-5
```

### 38.3.4.2 Forwarding Process Example

#### *38.3.4.2.1 Tagged Frames*

1. First the switch checks the VLAN ID (VID) of tagged frames or assigns temporary VIDs to untagged frames.
2. The switch then checks the VID in a frame's tag against the SVLAN table.

3 The switch notes what the SVLAN table says (that is, the SVLAN tells the switch whether or not to forward a frame and if the forwarded frames should have tags).

4 Then the switch applies the port filter to finish the forwarding decision. This means that frames may be dropped even if the SVLAN says to forward them. Frames might also be dropped if they are sent to a CPE (customer premises equipment) DSL device that does not accept tagged frames.

#### *38.3.4.2.2 Untagged Frames*

1 An untagged frame comes in from the LAN.

2 The switch checks the PVID table and assigns a temporary VID of 1.

3 The switch ignores the port from which the frame came, because the switch does not send a frame to the port from which it came. The switch also does not forward frames to "forbidden" ports.

4 If after looking at the SVLAN, the switch does not have any ports to which it will send the frame, it won't check the port filter.

### 38.3.5 Delete VLAN ID

Syntax:

```
no vlan <vlan-id>
```

where

`<vlan-id>` = The VLAN ID [1 – 4094].

This command deletes the specified VLAN ID entry from the static VLAN table. The following example deletes entry 2 in the static VLAN table.

```
ras (config)# no vlan 2
```

## 38.4 Enable VLAN

Syntax:

```
vlan <vlan-id>
```

This command enables the specified VLAN ID in the SVLAN (Static VLAN) table.

## 38.5 Disable VLAN

Syntax:

```
vlan <vlan-id> inactive
```

This command disables the specified VLAN ID in the SVLAN (Static VLAN) table.

## 38.6 Show VLAN Setting

Syntax:

```
show vlan
```

This command shows the IEEE 802.1Q Tagged SVLAN (Static VLAN) table.

An example is shown next.

- VID is the VLAN identification number.
- Status shows whether the VLAN is static or active.
- Elap-Time is the time since the VLAN was created on the switch.
- The `TagCtl` section of the last column shows which ports are tagged and which are untagged.

```
ras# show vlan
  The Number of VLAN:    3
  Idx. VID   Status    Elap-Time    TagCtl
  ---- ----  -------- ------------ ------------------------
  1    1    Static     0:12:13  Untagged :1-28
                                    Tagged   :

  1   100    Static     0:00:17  Untagged :
                                    Tagged   :1-24

  1   200    Static     0:00:07  Untagged :1-12
                                    Tagged   :13-28
```

# CHAPTER 39
# Multicast VLAN Registration Commands

This chapter shows you how to use Multicast VLAN Registration (mvr) commands.

## 39.1 Overview

Use the mvr commands in the configuration mode to create and configure multicast VLANs.

**Note:** If you want to enable IGMP snooping see Section 36.1 on page 275.

## 39.2 Create Multicast VLAN

Use the following commands in the config-mvr mode to configure a multicast VLAN group.

Syntax:

```
mvr <vlan-id>
mvr <vlan-id> source-port <port-list>
mvr <vlan-id> receiver-port <port-list>
mvr <vlan-id> inactive
mvr <vlan-id> mode <dynamic|compatible>
mvr <vlan-id> name <name-str>
mvr <vlan-id> tagged <port-list>
mvr <vlan-id> group <name-str> start-address <ip> end-address
<ip>
mvr <vlan-id> exit
```

where

| | | |
|---|---|---|
| `<vlan-id>` | = | The VLAN ID [1 – 4094]. |
| `source-port <port-list>` | = | Specifies the MVR source ports which send and receive multicast traffic. |
| `receiver-port <port-list>` | = | Specifies the MVR receiving ports which only receive multicast traffic. |
| `name <name-str>` | = | A name to identify the multicast VLAN group. |
| `mode <dynamic\|compatible>` | = | Specifies dynamic (sends IGMP reports to all source ports in the multicast VLAN) or compatible (does not send IGMP reports). |

| | | |
|---|---|---|
| `group name <name-str>` | = | A name to identify the MVR IP multicast group . |
| `start-address <ip>` | = | Specifies the starting IP multicast address of the multicast group in dotted decimal notation. |
| `end-address <ip>` | = | Specifies the ending IP multicast address of the multicast group in dotted decimal notation. Enter the same IP address as the start-address if you want to configure only one IP address for the multicast group. |

- Enter MVR mode. Create a multicast VLAN with the name `multiVlan` and the VLAN ID of 3.
- Specify source ports 21-23, 25 and receiver ports 26-29.
- Specify dynamic mode for the mutlicast group.
- Configure MVR multicast group addresses by the name of `ipgroup`.
- Exit MVR mode.

See the following example.

```
ras(config)# mvr 3 name multivlan
ras(config-mvr)# source-port 21-23, 25 receiver-port 26-29
ras(config-mvr)# mode dynamic
ras(config-mvr)# group ipgroup start-address 224.0.0.1 end-address
224.0.0.255
ras(config-mvr)# exit
```

# CHAPTER 40
# Troubleshooting

This chapter covers potential problems and possible remedies.

## 40.1 Problems Starting Up the Switch

**Table 88** Troubleshooting the Start-Up of Your Switch

| PROBLEM | CORRECTIVE ACTION |
|---|---|
| None of the LEDs turn on when you turn on the switch. | Check the power connection and make sure the power source is turned on. |
| | If the error persists, you may have a hardware problem. In this case, you should contact your vendor. |

## 40.2 Problems Accessing the Switch

**Table 89** Troubleshooting Accessing the Switch

| PROBLEM | CORRECTIVE ACTION |
|---|---|
| I cannot access the switch using Telnet. | Make sure the ports are properly connected.<br>You may have exceeded the maximum number of concurrent Telnet sessions. Close other Telnet session(s) or try connecting again later.<br>Check that you have enabled Telnet service access. If you have configured a secured client IP address, your computer's IP address must match it. Refer to the chapter on access control for details. |
| I cannot access the web configurator. | The administrator username is "admin". The default administrator password is "1234". The username and password are case-sensitive. Make sure that you enter the correct password and username using the proper casing. If you have changed the password and have now forgotten it, you will need to upload the default configuration file. This restores all of the factory defaults including the password.<br>Check that you have enabled web service access. If you have configured a secured client IP address, your computer's IP address must match it. Refer to the chapter on access control for details.<br>Your computer's and the switch's IP addresses must be on the same subnet.<br>See the following section to check that pop-up windows, JavaScripts and Java permissions are allowed. |

## 40.2.1 Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

**Note:** Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

### 40.2.1.1 Internet Explorer Pop-up Blockers

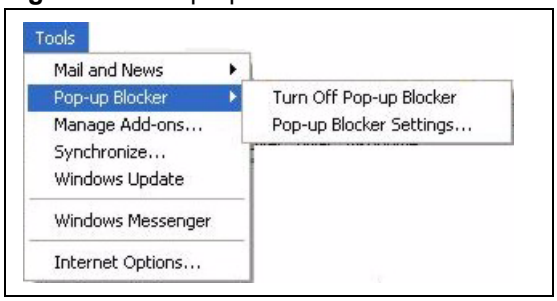
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

#### 40.2.1.1.1 Disable pop-up Blockers

1. In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

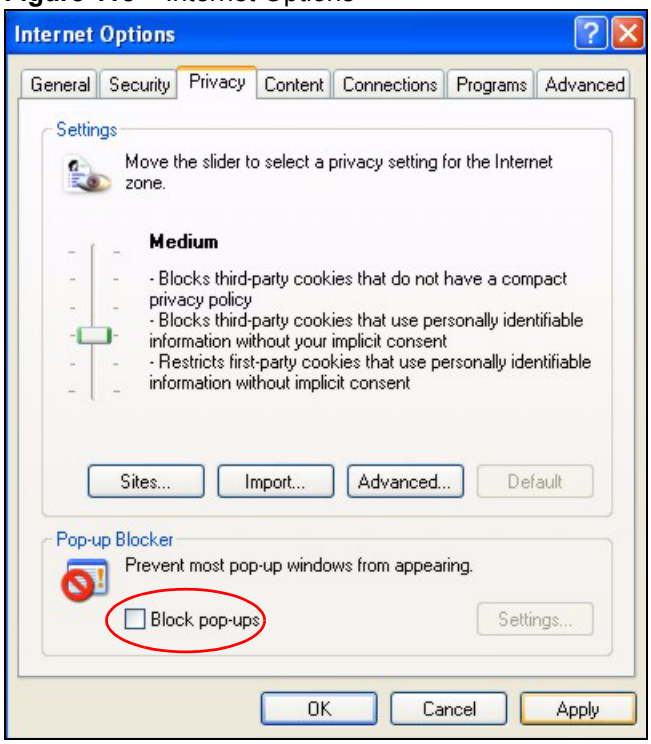
**Figure 117** Pop-up Blocker




You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1. In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.
2. Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

**Figure 118** Internet Options




**3** Click **Apply** to save this setting.

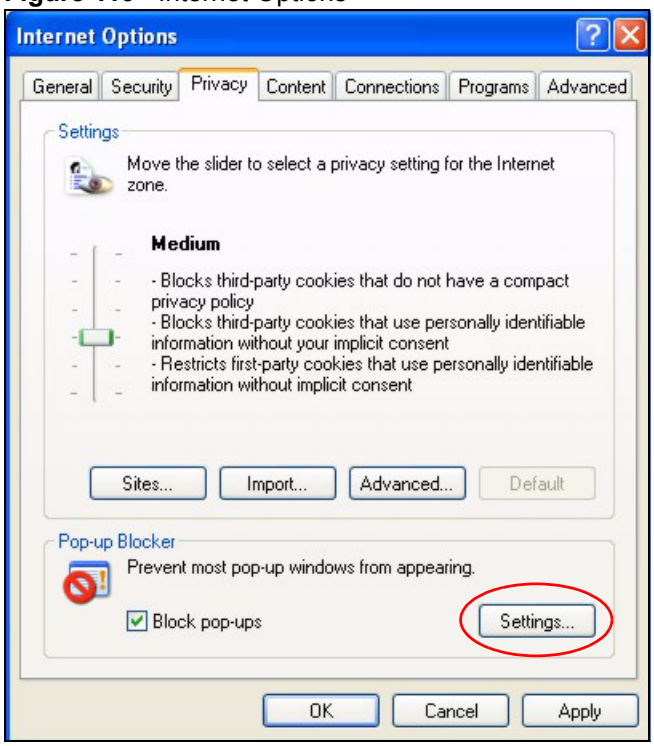
### 40.2.1.1.2 Enable pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

**1** In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

**2** Select **Settings…**to open the **Pop-up Blocker Settings** screen.

**Figure 119** Internet Options




3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.1.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

**Figure 120** Pop-up Blocker Settings

Pop-up Blocker Settings
Exceptions
Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.
Address of Web site to allow:
http://192.168.1.1
Add
Allowed sites:
Remove
Remove All
Notifications and Filter Level
Play a sound when a pop-up is blocked.
Show Information Bar when a pop-up is blocked.
Filter Level:
Medium: Block most automatic pop-ups
Pop-up Blocker FAQ
Close

5 Click **Close** to return to the **Privacy** screen.

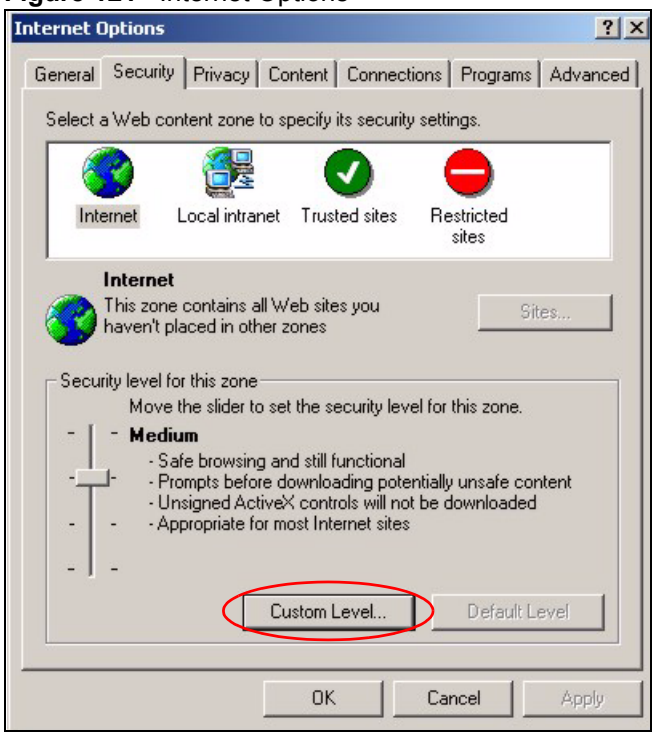
6 Click **Apply** to save this setting.

### 40.2.1.2 JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

**Figure 121** Internet Options




2 Click the **Custom Level...** button.

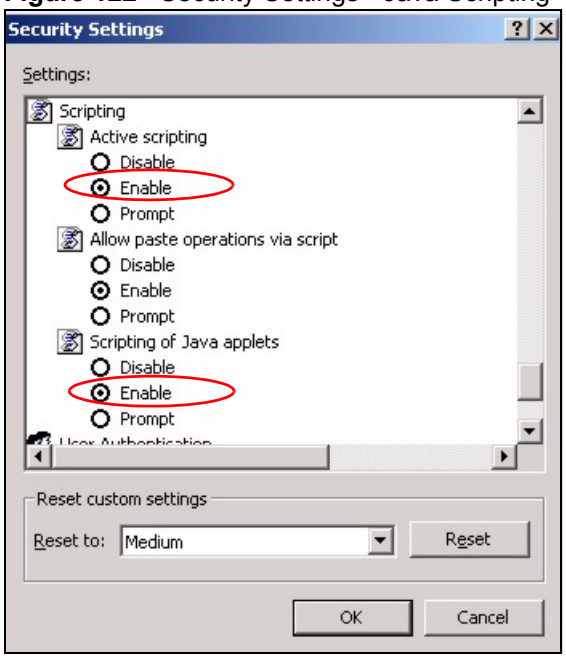
3 Scroll down to **Scripting**.

4 Under **Active scripting** make sure that **Enable** is selected (the default).

5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).

6 Click **OK** to close the window.

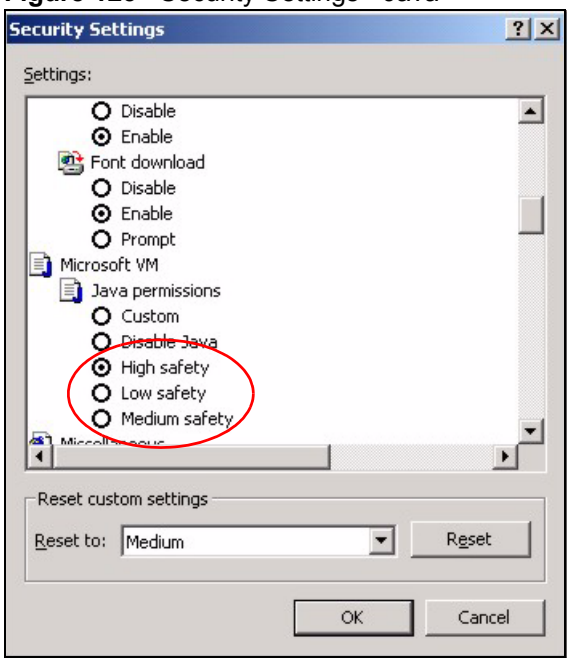
**Figure 122** Security Settings - Java Scripting




### 40.2.1.3 Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

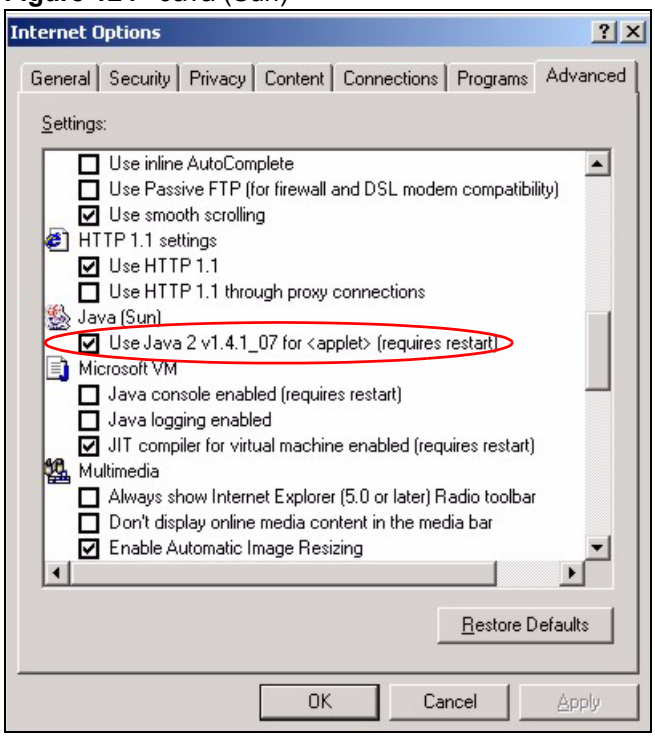
**Figure 123** Security Settings - Java




#### 40.2.1.3.1 JAVA (Sun)

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2. make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3. Click **OK** to close the window.

**Figure 124** Java (Sun)




## 40.3 Problems with the Password

**Table 90** Troubleshooting the Password

| PROBLEM | CORRECTIVE ACTION |
|---|---|
| Cannot access the switch. | The password field is case sensitive. Make sure that you enter the correct password using the proper casing. |
| | The administrator username is "admin". The default administrator password is "1234". The username and password are case-sensitive. Make sure that you enter the correct password and username using the proper casing. If you have changed the password and have now forgotten it, you will need to upload the default configuration file. This restores all of the factory defaults including the password. |

# APPENDIX A
# Product Specifications

These are the switch product specifications.

**Table 91** General Product Specifications

| | |
|---|---|
| Ethernet Interface | 24 10/100 Base-TX interfaces<br>Auto-negotiation<br>Auto-MDI/MDIX<br>Compliant with IEEE 802.3/3u<br>Back pressure flow control for half duplex<br>Flow control for full duplex (IEEE 802.3x)<br>RJ-45 Ethernet cable connector |
| Gigabit Interface | 2 GbE Dual Personality interfaces (Each interface has one 1000Base-T copper port and one Small Form-Factor Pluggable (SFP) fiber port, with one port active at a time.) |
| Bridging | 16K MAC addresses<br>Static MAC address filtering (port lock)<br>Broadcast storm control<br>Limited maximum number of MAC addresses per port |
| Switching | Switching fabric: 13.6Gbps, non-blocking<br>Max. Frame size: 1522 bytes<br>Forwarding frame: IEEE 802.3, IEEE 802.1q, Ethernet II, PPPoE<br>Prevent the forwarding of corrupted packets |
| STP<br>RSTP | IEEE 802.1d spanning tree protocol<br>IEEE 802.1w, rapid reconfiguration to recover network failure<br>Up to 6 STP configurations |
| QoS | IEEE 802.1p<br>Eight priority queues<br>Supports RFC 2475 DiffServ, DSCP to IEEE 802.1p priority mapping |
| Security | IEEE 802.1x port-based authentication<br>Static MAC Address Forward |
| VLAN | Port-based VLAN setting<br>Tag-based (IEEE 802.1Q) VLAN<br>Number of VLAN: 4K (256 static VLANs)<br>Supports GVRP<br>Protocol based VLAN support |
| Link aggregation | Supports IEEE 802.3ad; static and dynamic (LACP) port trunking<br>Up to six groups and each group can aggregate up to eight ports |
| Port mirroring | All ports support port mirroring |
| Bandwidth control | Supports rate limiting at 64Kbps increment |

**Table 92** Management Specifications

| | |
|---|---|
| System Control | Alarm/Status surveillance<br>LED indication for alarm and system status<br>Performance monitoring<br>Line speed<br>Four RMON groups (history, statistics, alarms, and events)<br>Throughput monitoring<br>CMP packet transmission<br>Port mirroring and aggregation<br>Spanning Tree Protocol<br>IGMP snooping<br>Firmware upgrade and download through FTP/TFTP<br>Login authorization and security levels (read only and read/write)<br>Self diagnostics<br>FLASH memory |
| Network Management | CLI through console port and telnet<br>Web-based management<br>Clustering: up to 24 switches can be manage by one IP<br>SNMP<br>RMON groups (history, statistics, alarms and events) |
| MIB | RFC1213 MIB II<br>RFC1493 Bridge MIB<br>RFC1643 Ethernet MIB<br>RFC1757 Four groups of RMON<br>RFC2011 IP MIB·<br>RFC2012 TCP MIB<br>RFC2013 UDP MIB<br>RFC2674 Bridge MIB extension (for IEEE 802.1Q) |

**Table 93** Physical and Environmental Specifications

| | |
|---|---|
| LEDs | Per switch: PWR, SYS, ALM, BPS<br>Per Ethernet port: LNK/ACT, FDX |
| Dimension | 438 mm (W) x 270 mm (D) x 44.45 mm (H)<br>Standard 19" rack mountable |
| Weight | 4.2Kg |
| Temperature | Operating: 0º C ~ 45º C<br>Storage: -10º C ~ 70º C |
| Humidity | 10 ~ 90% (non-condensing) |
| Power Supply | Overload protection<br>100-240VAC, 50/60Hz, 1.5A Max. |

**Table 93** Physical and Environmental Specifications (continued)

| | |
|---|---|
| Safety | ANS/UL 60950-1<br>CSA 60950-1<br>EN 60950-1<br>IEC 60950-1 |
| EMC | FCC Part 15 (Class A)<br>CE EMC (Class A) |

# APPENDIX B
# IP Addresses and Subnetting

This appendix introduces IP addresses, IP address classes and subnet masks. You use subnet masks to subdivide a network into smaller logical networks.

## Introduction to IP Addresses

An IP address has two parts: the network number and the host ID. Routers use the network number to send packets to the correct network, while the host ID identifies a single device on the network.

An IP address is made up of four octets, written in dotted decimal notation, for example, 192.168.1.1. (An octet is an 8-digit binary number. Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.)

There are several classes of IP addresses. The first network number (192 in the above example) defines the class of IP address. These are defined as follows:

- Class A: 0 to 127
- Class B: 128 to 191
- Class C: 192 to 223
- Class D: 224 to 239
- Class E: 240 to 255

## IP Address Classes and Hosts

The class of an IP address determines the number of hosts you can have on your network.

- In a class A address the first octet is the network number, and the remaining three octets are the host ID.
- In a class B address the first two octets make up the network number, and the two remaining octets make up the host ID.
- In a class C address the first three octets make up the network number, and the last octet is the host ID.

The following table shows the network number and host ID arrangement for classes A, B and C.

**Table 94** Classes of IP Addresses

| IP ADDRESS | OCTET 1 | OCTET 2 | OCTET 3 | OCTET 4 |
|---|---|---|---|---|
| Class A | **Network number** | Host ID | Host ID | Host ID |
| Class B | **Network number** | **Network number** | Host ID | Host ID |
| Class C | **Network number** | **Network number** | **Network number** | Host ID |

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 for example). Therefore, to determine the total number of hosts allowed in a network, deduct two as shown next:

- A class C address (1 host octet: 8 host bits) can have $2^8 - 2$, or 254 hosts.
- A class B address (2 host octets: 16 host bits) can have $2^{16} - 2$, or 65534 hosts.

A class A address (3 host octets: 24 host bits) can have $2^{24} - 2$ hosts, or approximately 16 million hosts.

## IP Address Classes and Network ID

The value of the first octet of an IP address determines the class of an address.

- Class A addresses have a **0** in the leftmost bit.
- Class B addresses have a **1** in the leftmost bit and a **0** in the next leftmost bit.
- Class C addresses start with **1 1 0** in the first three leftmost bits.
- Class D addresses begin with **1 1 1 0**. Class D addresses are used for multicasting, which is used to send information to groups of computers.
- There is also a class E. It is reserved for future use.

The following table shows the allowed ranges for the first octet of each class. This range determines the number of subnets you can have in a network.

**Table 95** Allowed IP Address Range By Class

| CLASS | ALLOWED RANGE OF FIRST OCTET (BINARY) | ALLOWED RANGE OF FIRST OCTET (DECIMAL) |
|---|---|---|
| Class A | **0**0000000 to **0**1111111 | 0 to 127 |
| Class B | **10**000000 to **10**111111 | 128 to 191 |
| Class C | **110**00000 to **110**11111 | 192 to 223 |
| Class D | **1110**0000 to **1110**1111 | 224 to 239 |
| Class E (reserved) | **1111**0000 to **1111**1111 | 240 to 255 |

# Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation).

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The "natural" masks for class A, B and C IP addresses are as follows.

**Table 96** "Natural" Masks

| CLASS | NATURAL MASK |
|---|---|
| A | 255.0.0.0 |
| B | 255.255.0.0 |
| C | 255.255.255.0 |

# Subnetting

With subnetting, the class arrangement of an IP address is ignored. For example, a class C address no longer has to have 24 bits of network number and 8 bits of host ID. With subnetting, some of the host ID bits are converted into network number bits.

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with mask 255.255.255.128.

The following table shows all possible subnet masks for a class "C" address using both notations.

**Table 97** Alternative Subnet Mask Notation

| SUBNET MASK | SUBNET MASK "1" BITS | LAST OCTET BIT VALUE | DECIMAL |
|---|---|---|---|
| 255.255.255.0 | /24 | 0000 0000 | 0 |
| 255.255.255.128 | /25 | 1000 0000 | 128 |
| 255.255.255.192 | /26 | 1100 0000 | 192 |
| 255.255.255.224 | /27 | 1110 0000 | 224 |

**Table 97** Alternative Subnet Mask Notation (continued)

| SUBNET MASK | SUBNET MASK "1" BITS | LAST OCTET BIT VALUE | DECIMAL |
|---|---|---|---|
| 255.255.255.240 | /28 | 1111 0000 | 240 |
| 255.255.255.248 | /29 | 1111 1000 | 248 |
| 255.255.255.252 | /30 | 1111 1100 | 252 |

The first mask shown is the class "C" natural mask. Normally if no mask is specified it is understood that the natural mask is being used.

# Example: Two Subnets

As an example, you have a class "C" address 192.168.1.0 with subnet mask of 255.255.255.0.

**Table 98** Two Subnets Example

| IP/SUBNET MASK | NETWORK NUMBER | HOST ID |
|---|---|---|
| IP Address | 192.168.1. | 0 |
| IP Address (Binary) | 11000000.10101000.00000001. | 00000000 |
| Subnet Mask | 255.255.255. | 0 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | 00000000 |

The first three octets of the address make up the network number (class "C").

To make two networks, divide the network 192.168.1.0 into two separate subnets by converting one of the host ID bits of the IP address to a network number bit. The "borrowed" host ID bit can be either "0" or "1" thus giving two subnets; 192.168.1.0 with mask 255.255.255.128 and 192.168.1.128 with mask 255.255.255.128.

**Note:** In the following charts, shaded/bolded last octet bit values indicate host ID bits "borrowed" to make network ID bits. The number of "borrowed" host ID bits determines the number of subnets you can have. The remaining number of host ID bits (after "borrowing") determines the number of hosts you can have on each subnet.

**Table 99** Subnet 1

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| IP Address | 192.168.1. | 0 |
| IP Address (Binary) | 11000000.10101000.00000001. | **0**0000000 |
| Subnet Mask | 255.255.255. | 128 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | **1**0000000 |

**Table 99** Subnet 1 (continued)

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| Subnet Address: 192.168.1.0 | Lowest Host ID: 192.168.1.1 | |
| Broadcast Address: 192.168.1.127 | Highest Host ID: 192.168.1.126 | |

**Table 100** Subnet 2

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| IP Address | 192.168.1. | 128 |
| IP Address (Binary) | 11000000.10101000.00000001. | **1**0000000 |
| Subnet Mask | 255.255.255. | 128 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | **1**0000000 |
| Subnet Address: 192.168.1.128 | Lowest Host ID: 192.168.1.129 | |
| Broadcast Address: 192.168.1.255 | Highest Host ID: 192.168.1.254 | |

Host IDs of all zeros represent the subnet itself and host IDs of all ones are the broadcast address for that subnet, so the actual number of hosts available on each subnet in the example above is $2^7 - 2$ or 126 hosts for each subnet.

192.168.1.0 with mask 255.255.255.128 is the subnet itself, and 192.168.1.127 with mask 255.255.255.128 is the directed broadcast address for the first subnet. Therefore, the lowest IP address that can be assigned to an actual host for the first subnet is 192.168.1.1 and the highest is 192.168.1.126. Similarly the host ID range for the second subnet is 192.168.1.129 to 192.168.1.254.

# Example: Four Subnets

The above example illustrated using a 25-bit subnet mask to divide a class "C" address space into two subnets. Similarly to divide a class "C" address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192. Each subnet contains 6 host ID bits, giving $2^6$-2 or 62 hosts for each subnet (all zeroes is the subnet itself, all ones is the broadcast address on the subnet).

**Table 101** Subnet 1

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| IP Address | 192.168.1. | 0 |
| IP Address (Binary) | 11000000.10101000.00000001. | **00**000000 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | **11**000000 |

**Table 101** Subnet 1 (continued)

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| Subnet Address: 192.168.1.0 | Lowest Host ID: 192.168.1.1 | |
| Broadcast Address: 192.168.1.63 | Highest Host ID: 192.168.1.62 | |

**Table 102** Subnet 2

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| IP Address | 192.168.1. | 64 |
| IP Address (Binary) | 11000000.10101000.00000001. | **01**000000 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | **11**000000 |
| Subnet Address: 192.168.1.64 | Lowest Host ID: 192.168.1.65 | |
| Broadcast Address: 192.168.1.127 | Highest Host ID: 192.168.1.126 | |

**Table 103** Subnet 3

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| IP Address | 192.168.1. | 128 |
| IP Address (Binary) | 11000000.10101000.00000001. | **10**000000 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | **11**000000 |
| Subnet Address: 192.168.1.128 | Lowest Host ID: 192.168.1.129 | |
| Broadcast Address: 192.168.1.191 | Highest Host ID: 192.168.1.190 | |

**Table 104** Subnet 4

| IP/SUBNET MASK | NETWORK NUMBER | LAST OCTET BIT VALUE |
|---|---|---|
| IP Address | 192.168.1. | 192 |
| IP Address (Binary) | 11000000.10101000.00000001. | **11**000000 |
| Subnet Mask (Binary) | 11111111.11111111.11111111. | **11**000000 |
| Subnet Address: 192.168.1.192 | Lowest Host ID: 192.168.1.193 | |
| Broadcast Address: 192.168.1.255 | Highest Host ID: 192.168.1.254 | |

# Example Eight Subnets

Similarly use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows class C IP address last octet values for each subnet.

**Table 105** Eight Subnets

| SUBNET | SUBNET ADDRESS | FIRST ADDRESS | LAST ADDRESS | BROADCAST ADDRESS |
|---|---|---|---|---|
| 1 | 0 | 1 | 30 | 31 |
| 2 | 32 | 33 | 62 | 63 |
| 3 | 64 | 65 | 94 | 95 |
| 4 | 96 | 97 | 126 | 127 |
| 5 | 128 | 129 | 158 | 159 |
| 6 | 160 | 161 | 190 | 191 |
| 7 | 192 | 193 | 222 | 223 |
| 8 | 224 | 225 | 254 | 255 |

The following table is a summary for class "C" subnet planning.

**Table 106** Class C Subnet Planning

| NO. "BORROWED" HOST BITS | SUBNET MASK | NO. SUBNETS | NO. HOSTS PER SUBNET |
|---|---|---|---|
| 1 | 255.255.255.128 (/25) | 2 | 126 |
| 2 | 255.255.255.192 (/26) | 4 | 62 |
| 3 | 255.255.255.224 (/27) | 8 | 30 |
| 4 | 255.255.255.240 (/28) | 16 | 14 |
| 5 | 255.255.255.248 (/29) | 32 | 6 |
| 6 | 255.255.255.252 (/30) | 64 | 2 |
| 7 | 255.255.255.254 (/31) | 128 | 1 |

# Subnetting With Class A and Class B Networks.

For class "A" and class "B" addresses the subnet mask also determines which bits are part of the network number and which are part of the host ID.

A class "B" address has two host ID octets available for subnetting and a class "A" address has three host ID octets (see Table 94 on page 322) available for subnetting.

The following table is a summary for class "B" subnet planning.

**Table 107** Class B Subnet Planning

| NO. "BORROWED" HOST BITS | SUBNET MASK | NO. SUBNETS | NO. HOSTS PER SUBNET |
|---|---|---|---|
| 1 | 255.255.128.0 (/17) | 2 | 32766 |
| 2 | 255.255.192.0 (/18) | 4 | 16382 |
| 3 | 255.255.224.0 (/19) | 8 | 8190 |
| 4 | 255.255.240.0 (/20) | 16 | 4094 |
| 5 | 255.255.248.0 (/21) | 32 | 2046 |
| 6 | 255.255.252.0 (/22) | 64 | 1022 |
| 7 | 255.255.254.0 (/23) | 128 | 510 |
| 8 | 255.255.255.0 (/24) | 256 | 254 |
| 9 | 255.255.255.128 (/25) | 512 | 126 |
| 10 | 255.255.255.192 (/26) | 1024 | 62 |
| 11 | 255.255.255.224 (/27) | 2048 | 30 |
| 12 | 255.255.255.240 (/28) | 4096 | 14 |
| 13 | 255.255.255.248 (/29) | 8192 | 6 |
| 14 | 255.255.255.252 (/30) | 16384 | 2 |
| 15 | 255.255.255.254 (/31) | 32768 | 1 |

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